VS1MD
AC Microdrive

10/10 **Installation & Operating Manual** MN760

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Important:
Be sure to check www.baldor.com for the latest software, firmware and drivers for your VS1 product. Also you can download the latest version of this manual in Adobe Acrobat PDF format.

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Chapter 1
Introduction

This manual is intended for qualified electrical personnel familiar with installing, programming, and maintaining AC Drives. This manual contains information on:

- Installing and wiring the VS1MD drive
- Programming the drive
- Troubleshooting the drive

1.1 Getting Assistance from Baldor

For technical assistance, contact your Baldor District Office. Before calling, please review the troubleshooting section of this manual and you will be asked for the drive model number or catalog number that is located on the Nameplate.

1.2 Safety Notice

This equipment contains voltages that may be as high as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.
This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

CLASSIFICATIONS OF CAUTIONARY STATEMENTS

WARNING: **Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.**

CAUTION: **Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.**

PRECAUTIONS

WARNING: **Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.**

WARNING: **Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.**

WARNING: **Do not use motor overload relays with an automatic reset feature. These are dangerous since the process may injure someone if a sudden or unexpected automatic restart occurs. If manual reset relays are not available, disable the automatic restart feature using external control wiring.**

WARNING: **This unit has an automatic restart feature that will start the motor whenever input power is applied and a RUN (FWD or REV) command is issued. If an automatic restart of the motor could cause injury to personnel, the automatic restart feature of the VS1MD should be disabled.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury.**

WARNING: **Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Dangerous voltages are present inside the equipment. Electrical shock can cause serious or fatal injury.**

WARNING: **Motor circuit may have high voltage present whenever AC power is applied, even when motor is not rotating. Electrical shock can cause serious or fatal injury.**

WARNING: **Improper operation of control may cause violent motion of the motor shaft and driven equipment. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Certain failure modes of the control can produce peak torque of several times the rated motor torque.**

WARNING: **Dynamic brake resistors may generate enough heat to ignite combustible materials. Keep all combustible materials and flammable vapors away from brake resistors.**

WARNING: **The motor shaft will rotate during the autotune procedure. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.**

WARNING: **MEDICAL DEVICE/PACEMAKER DANGER - Magnetic and electromagnetic fields in the vicinity of current carrying conductors and industrial motors can result in a serious health hazard to persons with cardiac pacemakers, internal cardiac defibrillators, neurostimulators, metal implants, cochlear implants, hearing aids, and other medical devices. To avoid risk, stay away from the area surrounding a motor and its current carrying conductors.**

CAUTION: **Disconnect motor leads (U, V and W) from control before you perform a "Dielectric Withstand" test on the motor. Failure to disconnect motor from the control will result in extensive damage to the control. The control is tested at the factory for high voltage / leakage resistance as part of Underwriter Laboratory requirements.**

CAUTION: **Suitable for use on a circuit capable of delivering not more than the RMS symmetrical short circuit amperes listed here at rated voltage. Horsepower RMS Symmetrical Amperes 1-30 5,000**

CAUTION: **Do not connect AC power to the Motor terminals U, V and W. Connecting AC power to these terminals may result in damage to the control.**

CAUTION: **Baldor recommends not to use "Grounded Leg Delta" transformer power leads that may create ground loops. Instead, we recommend using a four wire Wye.**

CAUTION: **If the DB hardware mounting is in any position other than vertical, the DB hardware must be derated by 35% of its rated capacity.**

CAUTION: **Only Baldor cables should be used to connect the keypad and control. These are special twisted pair cables to protect the control and keypad. Damage associated with other cable types are not covered by the Baldor warranty.**

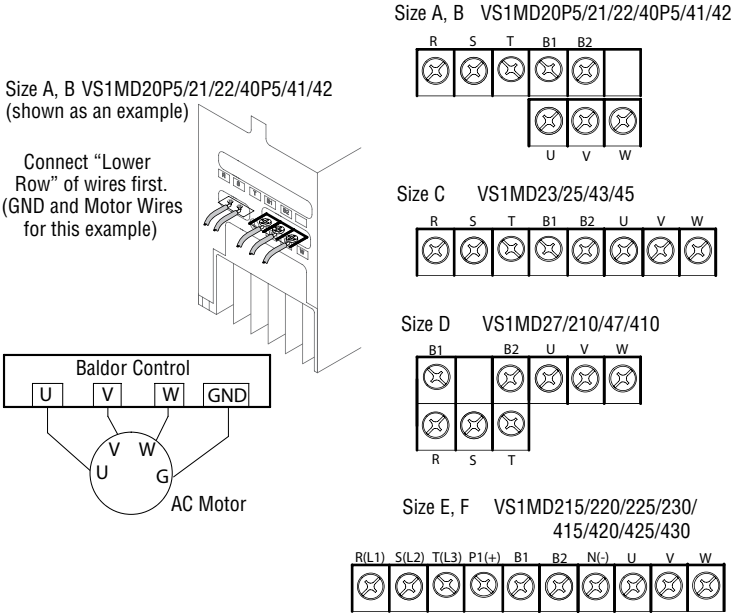
CAUTION: **If an M-Contactor is installed, the control must be disabled for at least 200msec before the M-Contactor is opened. If the M-Contactor is opened while the control is supplying voltage and current to the motor, the control may be damaged. Before the control is enabled, the M-Contactor must be closed for at least 200msec.**

CAUTION: **Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.**

1.3 Quick Start

Quick Start Guide is also available separately, see MS760.

Figure 1-1 Power and Motor Terminal Locations



Powerup Procedure Refer to Chapter 3, 4 and 5 for additional details.

1. Remove all power from the control.
2. Couple the motor to its load.
3. Verify freedom of motion of motor shaft.
4. Verify the motor coupling is tight without backlash.
5. Verify the holding brakes if any, are properly adjusted to fully release and set to the desired torque.
6. Connect Power & Motor, See Figure 1-1.
7. Connect input control wires, See Figure 1-2 and output control wires, See Figure 1-3.
8. Turn power on. Be sure there are no faults.
9. Set the following parameters for the values displayed on the motor nameplate:
   P30 Motor HP Select
   P32 Motor Rated Current
   P33 Pole Number
   P34 Base Frequency
10. If external dynamic brake hardware is used, set H75 DB Resistor Select and H76 DB Resistor Operating Rate parameters.
11. Run the drive from the keypad.
12. Select and program additional parameters to suit your application, see Chapter 7-Parameter Descriptions.

The control is now ready for use the in keypad mode. If a different operating mode is desired, refer to Chapter 7 Parameter Descriptions and Chapter 8 Customizing for your Application.

Basic drive defaults to V/Hz control. Refer to Section 8.5 and 8.6 for Sensorless Vector operation.

Figure 1-2 Input Connections 2Wire Start

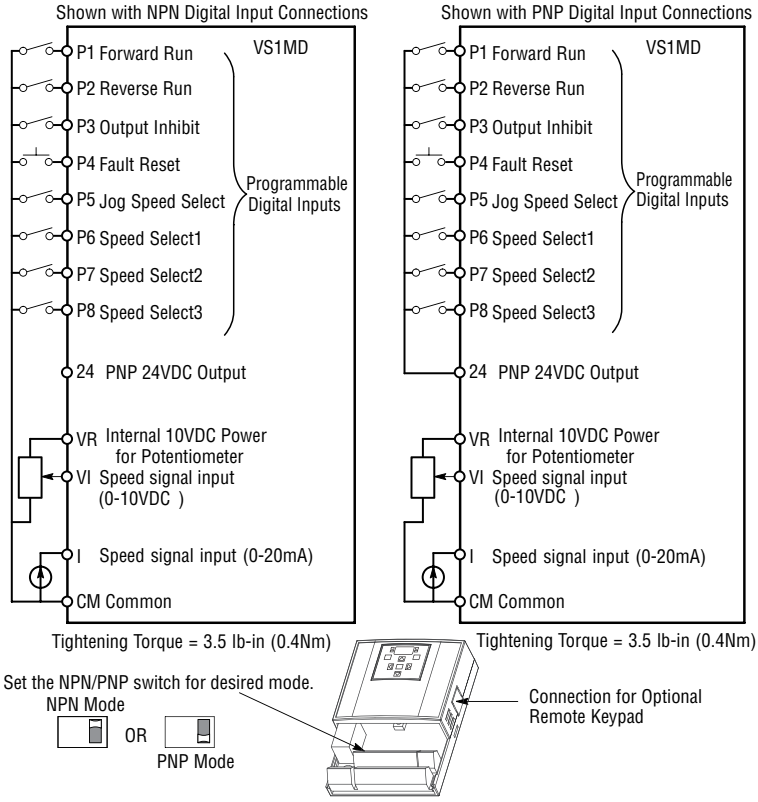
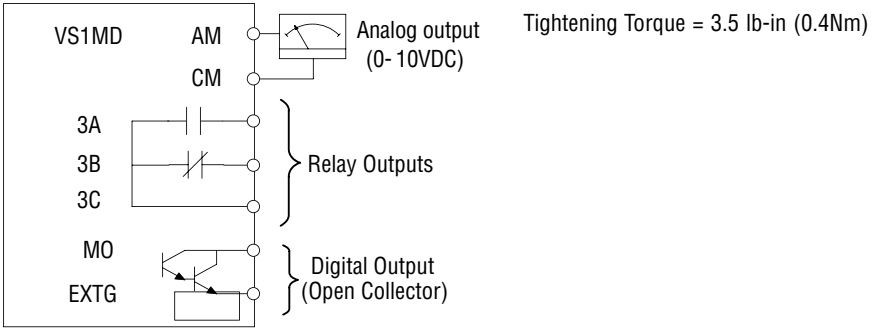


Figure 1-3 Output Connections



Chapter 2

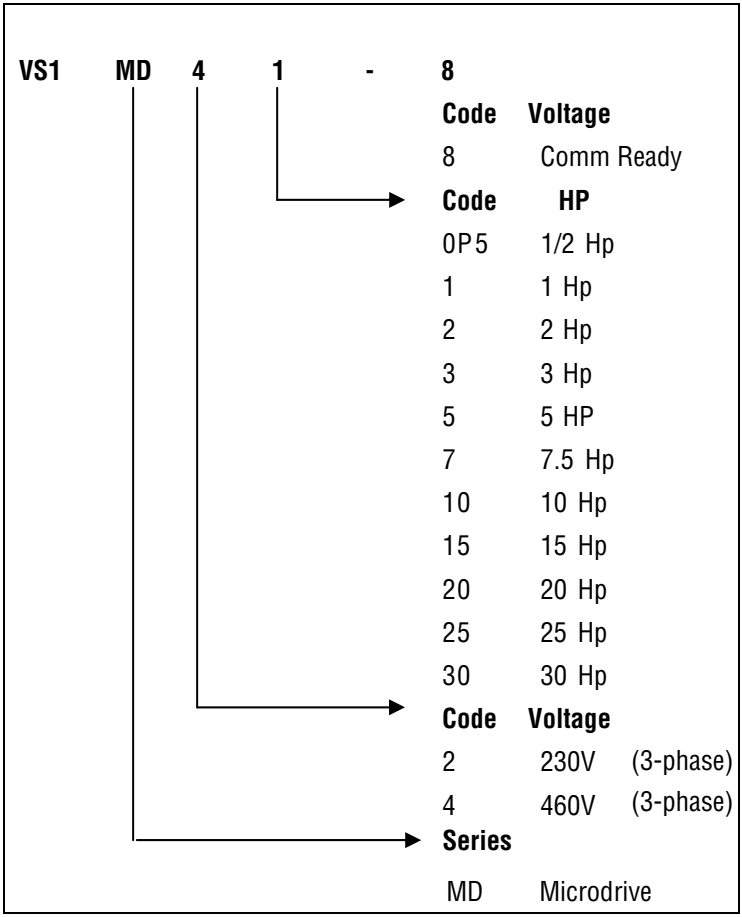
General Information and Ratings

The VS1MD is a variable frequency PWM drive capable of operating in open-loop, V/Hz (volts per hertz) mode and in a sensorless vector control (SVC) mode. This chapter contains information about the VS1MD drive, including how to identify the drive.

2.1 Identify the Drive by Model Number

Each drive can be identified by its model number, as shown in Figure 2-1. The model number is on the shipping label and the drive nameplate. The model number includes the drive and any options.

Figure 2-1 Drive Identification



2.2 VS1MD Ratings, Model Numbers and Frame Sizes

Table 2-2 has drive ratings for each VS1MD Model.

Table 2-1 VS1MD Ratings, Model Numbers and Frame Sizes

Catalog Number*	Frame Size	HP	KW	Output Current Amps	Input Current Amps
230V 50/60Hz 3-Phase					
VS1MD20P5	A	0.5	0.4	2.5	3.9
VS1MD21	A	1.0	0.75	5.0	6.6
VS1MD22	B	2.0	1.5	8.0	9.9
VS1MD23	C	3.0	2.2	12.0	14.5
VS1MD25	C	5.0	3.7	16.0	21.0
VS1MD27	D	7.5	5.5	24.0	35.0
VS1MD210	D	10.0	7.5	32.0	48.0
VS1MD215	E	15.0	11.0	46.0	58.0
VS1MD220	E	20.0	15.0	60.0	69.0
VS1MD225	F	25.0	18.5	74.0	88.0
VS1MD230	F	30.0	22.0	88.0	96.0
460V 50/60Hz 3-Phase					
VS1MD40P5	A	0.5	0.4	1.25	1.7
VS1MD41	A	1.0	0.75	2.5	3.6
VS1MD42	B	2.0	1.5	4.0	5.3
VS1MD43	C	3.0	2.2	6.0	7.2
VS1MD45	C	5.0	3.7	8.0	10.5
VS1MD47	D	7.5	5.5	12.0	11.9
VS1MD410	D	10.0	7.5	16.0	24.0
VS1MD415	E	15.0	11.0	24.0	39.0
VS1MD420	E	20.0	15.0	30.0	44.0
VS1MD425	F	25.0	18.5	39.0	57.0
VS1MD430	F	30.0	22.0	45.0	57.0

***Note:** All communication card ready models with a -8 at the end of the part have the identical ratings as the base model number drive.

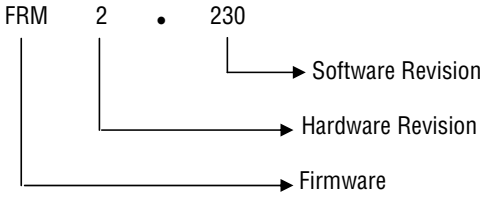
2.3 Storage Guidelines

If you need to store the drive, follow these recommendations to prolong drive life and performance:
1. Storage ambient temperature is -40°F to 158°F (-40°C to 70°C).
2. Storage Humidity range 0% to 90% RH non-condensing.
3. Do not expose to corrosive atmosphere.

2.4 Identify the Firmware Version

The shipping box and the drive nameplate contain a FRM number to indicate hardware and software versions.

Figure 2-2 Firmware Identification



2.4.1 Display Parameter

Display parameter d009 indicates the current firmware version.

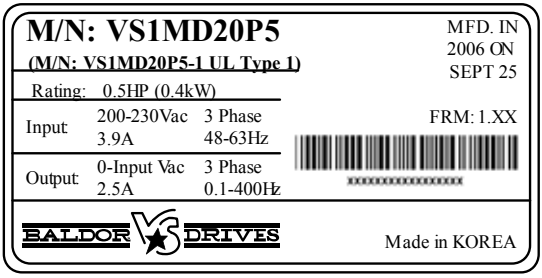
Table 2-2 Display Parameter

Date	Drive & Box	Firmware	Display d009
Original Version	FRM 1.00	V1.80	1.80
July 2007	FRM 1.10	V1.81	1.81
October 2007	FRM 1.20	V1.82	1.82
August 2008	FRM 2.210	V2.10	2.10
September 2009	FRM 2.212	V2.12	2.12
March 2010	FRM 2.220	V2.20	2.20
October 2010	FRM 2.230	V2.30	2.30

2.4.2 Drive Label

The drive nameplate shows the Firmware Version under the manufacture date.

Figure 2-3 Drive Label



2.4.3 Box Label

The shipping box shows the firmware version under the VS1MD logo.

Figure 2-4 Box Label

Chapter 3

Installing the Drive

This chapter provides information that must be considered when planning a VS1MD drive installation and provides drive mounting information and installation site requirements.

3.1 Receiving & Inspection

When you receive your control, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your control.
2. Remove the control from the shipping container and remove all packing materials from the control. The container and packing materials may be retained for future shipment.
3. Verify that the part number of the control you received is the same as the part number listed on your purchase order.
4. Inspect the control for external physical damage that may have been sustained during shipment and report any damage immediately to the commercial carrier that delivered your control.
5. If the control is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage humidity and temperature specifications stated in this manual.

3.2 General Requirements for the Installation Site

It is important to ensure that the drives environment and operating conditions are satisfactory.
The area behind the drive must be kept clear of all control and power wiring. Power connections may create electromagnetic fields that may interfere with control wiring or components when run in close proximity to the drive.
Read the recommendations in the following sections before continuing with the drive installation.

3.2.1 Operating Conditions

Before deciding on an installation site, consider the following guidelines:

- Protect the cooling fan by avoiding dust or metallic particles.
- Do not expose the drive to a corrosive atmosphere.
- Protect the drive from moisture and direct sunlight.
- Verify that the drive location will meet the environmental conditions specified in Table 3-1.

Table 3-1 Ambient Temperature and Mounting Clearances

Ambient Temperature		Enclosure Rating	Minimum Mounting Clearances
Minimum	Maximum		
14° F (-10° C)	122° F (50° C)	IP20/Open Type	2 in (50mm)
	104° F (40° C)	IP20/NEMA 1	2 in (50mm)
	122° F (50° C)	Side-by-Side	2 in (50mm)

3.2.2 Minimum Mounting Clearances

Be sure to provide proper top, bottom (4” minimum) and side clearance (2” minimum each side).

3.3 Mounting the Drive

Mount the drive upright on a flat, vertical, and level surface.

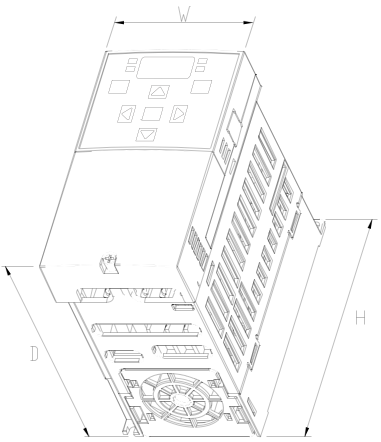
3.3.1 Drive Dimensions

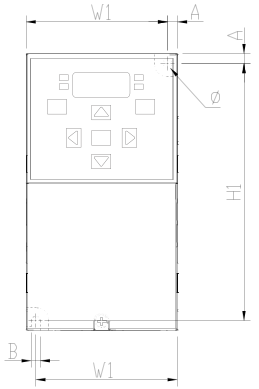
Dimensional data is located in Table 3-2.

Figure 3-1 Drive Dimensions - Frames A & B

Frame A Drive Dimensions
VS1MD20P5-8 / VS1MD40P5-8
VS1MD21 / VS1MD41

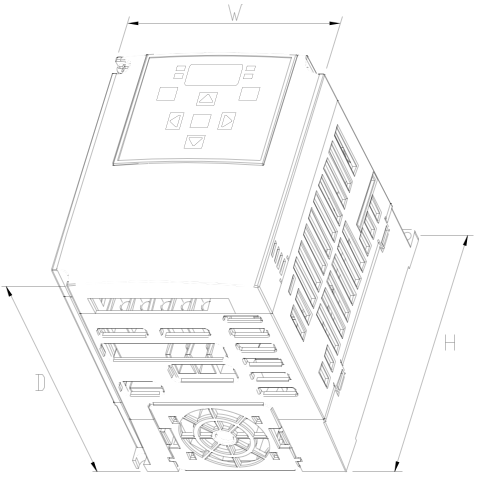
VS1MD20P5 / VS1MD40P5
VS1MD21-8 / VS1MD41-8





Frame B Drive Dimensions
VS1MD22 / VS1MD42

VS1MD22-8 / VS1MD42-8



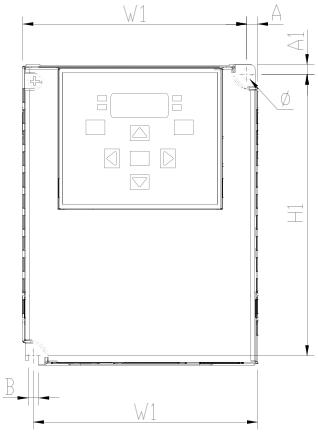


Figure 3-2 Drive Dimensions - Frames C & D

Frame C Drive Dimensions
VS1MD23 / VS1MD43
VS1MD25 / VS1MD45

VS1MD23-8 / VS1MD43-8
VS1MD25-8 / VS1MD45-8

Frame D Drive Dimensions
VS1MD27 / VS1MD47
VS1MD210 / VS1MD410

VS1MD27-8 / VS1MD47-8
VS1MD210-8 / VS1MD410-8

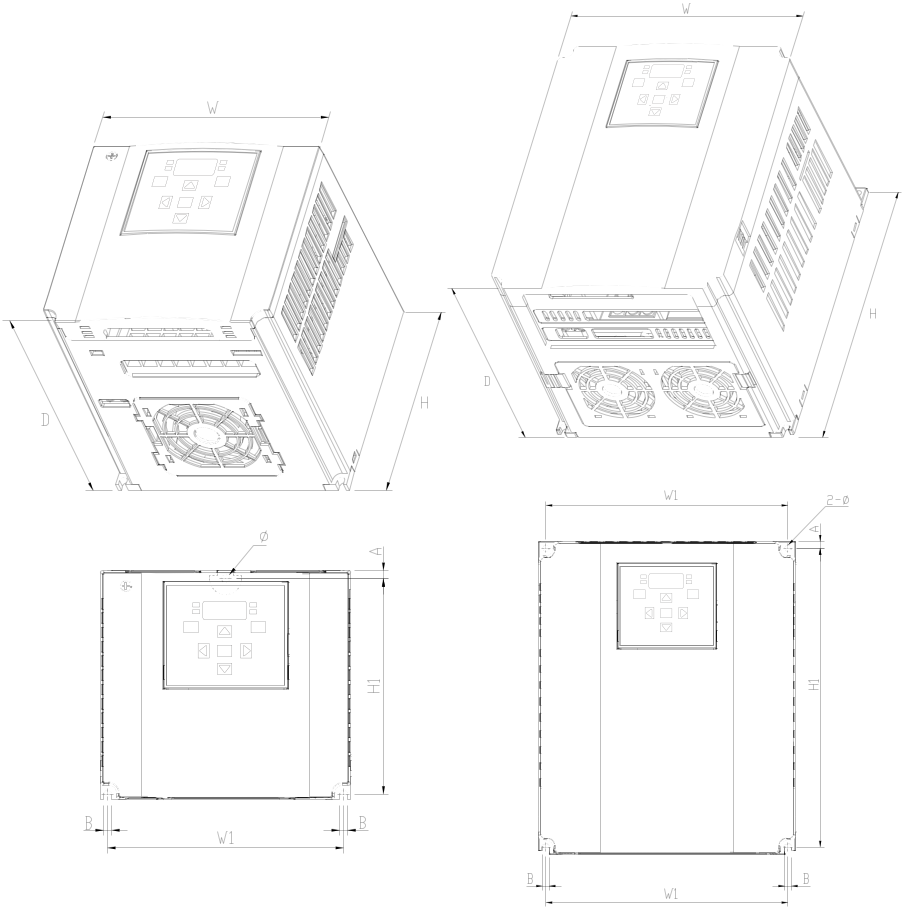


Figure 3-3 Drive Dimensions - Frames E & F

Frame E Drive Dimensions
VS1MD215 / VS1MD415
VS1MD220 / VS1MD420

Frame F Drive Dimensions
VS1MD225 / VS1MD425
VS1MD230 / VS1MD430

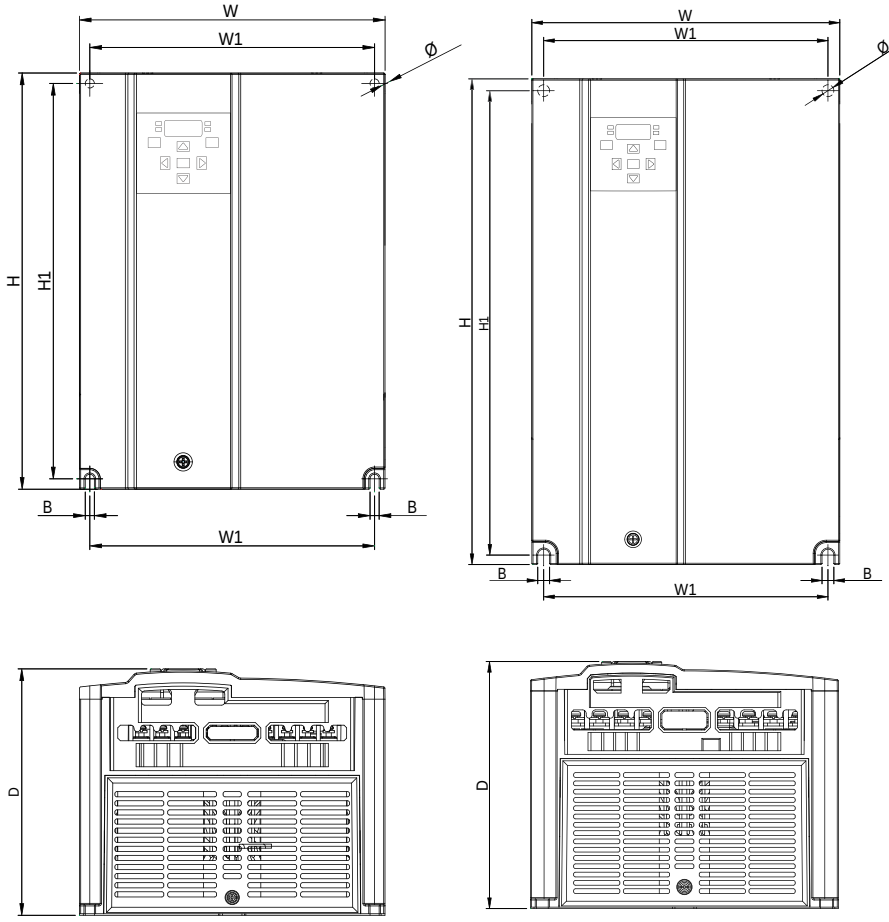


Table 3-2 Drive Dimensions

Catalog Number	Output HP	Frame	W	W1	H	H1	Depth	Ø	A	B	Weight lbs. (kg.)
			Inches (mm)								
230V 50/60Hz 3-Phase											
VS1MD20P5	0.5	A	2.75 (70)	2.58 (65.5)	5.04 (128)	4.69 (119)	5.12 (130)	0.16 (4)	0.18 (4.5)	0.16 (4)	1.7 (0.76)
VS1MD21	1	A	2.75 (70)	2.58 (65.5)	5.04 (128)	4.69 (119)	5.12 (130)	0.16 (4)	0.18 (4.5)	0.16 (4)	1.7 (0.76)
VS1MD22	2	B	3.94 (100)	3.76 (95.5)	5.04 (128)	4.72 (120)	5.12 (130)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	2.5 (1.12)
VS1MD23	3	C	5.20 (140)	5.20 (140)	5.04 (128)	4.74 (120.5)	6.10 (155)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	4.0 (1.84)
VS1MD25	5	C	5.20 (140)	5.20 (140)	5.04 (128)	4.74 (120.5)	6.10 (155)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	4.0 (1.84)
VS1MD27	7.5	D	7.08 (180)	6.69 (170)	8.66 (220)	8.27 (210)	6.69 (170)	0.18 (4.5)	0.20 (5)	0.18 (4.5)	8.07 (3.66)
VS1MD210	10	D	7.08 (180)	6.69 (170)	8.66 (220)	8.27 (210)	6.69 (170)	0.18 (4.5)	0.20 (5)	0.18 (4.5)	8.07 (3.66)
VS1MD215	15	E	11.30 (235)	8.62 (219)	15.40 (320)	11.97 (304)	9.12 (189.5)	0.28 (7)	0.31 (8)	0.28 (7)	19.8 (9)
VS1MD220	20	E	11.30 (235)	8.62 (219)	15.40 (320)	11.97 (304)	9.12 (189.5)	0.28 (7)	0.31 (8)	0.28 (7)	19.8 (9)
VS1MD225	25	F	12.50 (260)	9.45 (240)	19.73 (410)	15.43 (392)	10.0 (208.5)	0.39 (10)	0.39 (10)	0.39 (10)	29.3 (13.3)
VS1MD230	30	F	12.50 (260)	9.45 (240)	19.73 (410)	15.43 (392)	10.0 (208.5)	0.39 (10)	0.39 (10)	0.39 (10)	29.3 (13.3)
460V 50/60Hz 3-Phase											
VS1MD40P5	0.5	A	2.75 (70)	2.58 (65.5)	5.04 (128)	4.69 (119)	5.12 (130)	0.16 (4)	0.18 (4.5)	0.16 (4)	1.7 (0.76)
VS1MD41	1	A	2.75 (70)	2.58 (65.5)	5.04 (128)	4.69 (119)	5.12 (130)	0.16 (4)	0.18 (4.5)	0.16 (4)	1.7 (0.76)
VS1MD42	2	B	3.94 (100)	3.76 (95.5)	5.04 (128)	4.72 (120)	5.12 (130)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	2.5 (1.12)
VS1MD43	3	C	5.20 (140)	5.20 (140)	5.04 (128)	4.74 (120.5)	6.10 (155)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	4.0 (1.84)
VS1MD45	5	C	5.20 (140)	5.20 (140)	5.04 (128)	4.74 (120.5)	6.10 (155)	0.18 (4.5)	0.18 (4.5)	0.18 (4.5)	4.2 (1.89)
VS1MD47	7.5	D	7.08 (180)	6.69 (170)	8.66 (220)	8.27 (210)	6.69 (170)	0.18 (4.5)	0.20 (5)	0.18 (4.5)	8.07 (3.66)
VS1MD410	10	D	7.08 (180)	6.69 (170)	8.66 (220)	8.27 (210)	6.69 (170)	0.18 (4.5)	0.20 (5)	0.18 (4.5)	8.07 (3.66)
VS1MD415	15	E	11.30 (235)	8.62 (219)	15.40 (320)	11.97 (304)	9.12 (189.5)	0.28 (7)	0.31 (8)	0.28 (7)	19.8 (9)

Table 3-2 Drive Dimensions Continued

Catalog Number	Output HP	Frame	W	W1	H	H1	Depth	Ø	A	B	Weight lbs. (kg.)
			Inches (mm)								
VS1MD420	20	E	11.30 (235)	8.62 (219)	15.40 (320)	11.97 (304)	9.12 (189.5)	0.28 (7)	0.31 (8)	0.28 (7)	19.8 (9)
VS1MD425	25	F	12.50 (260)	9.45 (240)	19.73 (410)	15.43 (392)	10.0 (208.5)	0.39 (10)	0.39 (10)	0.39 (10)	29.3 (13.3)
VS1MD430	30	F	12.50 (260)	9.45 (240)	19.73 (410)	15.43 (392)	10.0 (208.5)	0.39 (10)	0.39 (10)	0.39 (10)	29.3 (13.3)

3.3.2 Protecting the Drive from Debris

The drive must be protected from debris falling through the drive vents during installation and operation. The drive is designed to operating in IP20/NEMA 1 Type Installation with the addition of a drip cover and a conduit box available in NEMA1 Conduit Box Kit. Kit part numbers and additional information can be found on pages D2 - D6.

3.3.3 Watts Loss Data

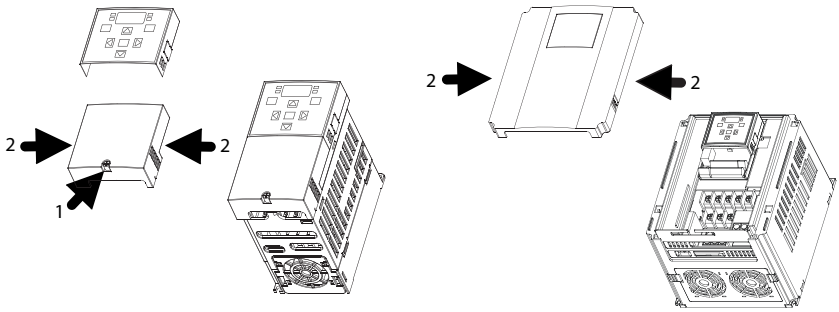
Table 3-3 Watts Loss Data

Catalog Number	Input Volt	Frame	Watts Loss
VS1MD20P5	230	A	13
VS1MD21	230	A	28
VS1MD22	230	B	18
VS1MD23	230	C	56
VS1MD25	230	C	98
VS1MD27	230	D	73
VS1MD210	230	D	70
VS1MD215	230	E	290
VS1MD220	230	E	683
VS1MD225	230	F	759
VS1MD230	230	F	799
VS1MD40P5	460	A	9
VS1MD41	460	A	22
VS1MD42	460	B	32
VS1MD43	460	C	47
VS1MD45	460	C	94
VS1MD47	460	D	84
VS1MD410	460	D	113
VS1MD415	460	E	293
VS1MD420	460	E	608
VS1MD425	460	F	759
VS1MD430	460	F	1019

3.4 Cover Removal

To connect power and signal wires, the cover must be removed. Remove the cover as shown in Figure 3-4.

Figure 3-4 Cover Removal



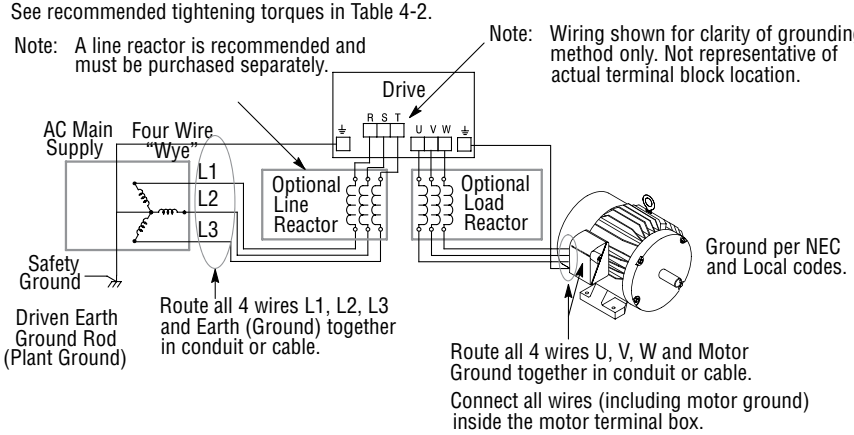
1. Loosen screw.
2. Press in (both sides), then lift cover to remove.

4.1 Overview of Power Connections

The recommended grounding method is shown in Figure 4-1.

Safety Ground - (G)
This is the safety ground for the drive that is required by code. One of these points must be connected to adjacent building steel (girder, joist), a floor ground rod, or bus bar. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Figure 4-1 Recommended System Grounding


See recommended tightening torques in Table 4-2.
Note: A line reactor is recommended and must be purchased separately.
Note: Wiring shown for clarity of grounding method only. Not representative of actual terminal block location.
Drive
R S T
U V W
AC Main Supply
Four Wire "Wye"
L1
L2
L3
Optional Line Reactor
Optional Load Reactor
Safety Ground
Driven Earth Ground Rod (Plant Ground)
Route all 4 wires L1, L2, L3 and Earth (Ground) together in conduit or cable.
Ground per NEC and Local codes.
Route all 4 wires U, V, W and Motor Ground together in conduit or cable.
Connect all wires (including motor ground) inside the motor terminal box.

Motor Ground
The motor ground must be connected to one of the ground terminals on the drive.

Shield Termination
Either of the safety ground terminals located on the power terminal block provides a grounding point for the motor cable shield. The motor cable shield connected to one of these terminals (drive end) should also be connected to the motor frame (motor end). Use a shield terminating or EMI clamp to connect the shield to the safety ground terminal. The NEMA 1/IP30 Kit may be used with a cable clamp for a grounding point for the cable shield.
When shielded cable is used for control and signal wiring, the shield should be grounded at the drive end only, never at both ends.

RFI Filter Grounding
Using single-phase drives with integral filter, or an external filter with any drive rating, may result in relatively high ground leakage currents. Therefore, the filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded (bonded) to the building power distribution ground.
Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be checked periodically.

4.2 Power Disconnect

A power disconnect should be installed between the input power service and the drive for a fail safe method to disconnect power. The drive will remain in a powered-up condition until all input power is removed from the drive and the internal bus voltage is depleted.

4.3 Protective Devices

Recommended fuse sizes are based on the following:
115% of maximum continuous current for time delay.
150% of maximum continuous current for Fast or Very Fast action.

Note: These recommendations do not consider harmonic currents or ambient temperatures greater than 45°C. Be sure a suitable input power protection device is installed. Use the recommended fuses and wire sizes shown in Table 4-1 is based on the use of copper conductor wire rated at 75°C.

The table is specified for NEMA B motors.

Fast Action Fuses:	240VAC,Buss® KTN;	460VAC, Buss® KTS
Very Fast Action:	240VAC, Buss® JJN;	460VAC, Buss® JJS
Semiconductor	240VAC,	Ferraz Shawmut A50QS

Buss® is a trademark of Cooper Industries, Inc.

4.3.1 Input Fuses and Reactors

Table 4-1 Recommended Fuses, Reactors

Catalog Number	AC Input Fuse (External Voltage)		AC Reactor	DC Reactor
	Current	Voltage		
VS1MD20P5	10A	500V	4.20 mH, 3.5A	-
VS1MD21	10A	500V	2.13 mH, 5.7A	-
VS1MD22	15A	500V	1.20 mH, 10A	-
VS1MD23	25A	500V	0.88 mH, 14A	-
VS1MD25	30A	500V	0.56 mH, 20A	-
VS1MD27	30A	500V	0.39 MH, 30A	-
VS1MD210	50A	500V	0.28 mH, 40A	-
VS1MD215	70A	500V	0.20 mH, 40A	0.74 mH, 56A
VS1MD220	100A	500V	0.15 mH, 75A	0.57 mH, 71A
VS1MD225	100A	500V	0.12 mH, 96 A	0.49 mH, 91A
VS1MD230	125A	500V	0.10 mH, 112A	0.42 mH, 107A
VS1MD40P5	5A	500V	18 mH, 1.3A	-
VS1MD41	10A	500V	8.63 mH, 2.8A	-
VS1MD42	10A	500V	4.81 mH, 4.8A	-
VS1MD43	10A	500V	3.23 mH, 7.5A	-
VS1MD45	20A	500V	2.34 mH, 10A	-
VS1MD47	20A	500V	1.22 mH, 15A	-
VS1MD410	30A	500V	1.14 mH, 20A	-
VS1MD415	35A	500V	0.81 mH, 30A	2.76 mH, 29A
VS1MD420	45A	500V	0.61 mH, 38A	2.18 MH, 36A
VS1MD425	60A	500V	0.45 mH, 50A	1.79 mH, 48A
VS1MD430	70A	500V	0.39 mH, 58A	1.54 mH, 55A

Short Circuit Ratings

Suitable for use on a circuit capable of delivering not more then 65KVA symmetrical amperes maximum for all 240V and 460V drives.

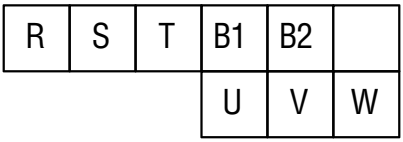
Short Circuit Fuse/Breaker Marking

Use Class H or K5 UL listed input fuse and UL listed breaker only. See Table 4-1 for the voltage and current rating of the fuse and breaker.

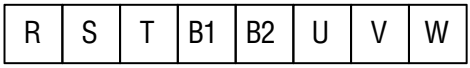
4.4 Power Terminal Block Wiring

Figure 4-2 Specification of Power Terminal Block Wiring

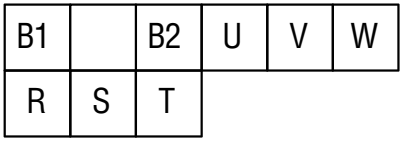
Capacity 0.5Hp to 2.0Hp



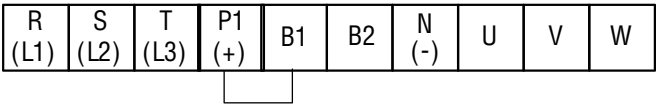
Capacity 3.0Hp to 5.0Hp



Capacity 7.5Hp to 10.0Hp



Capacity 15.0Hp to 30.0Hp



4.5 Electrical Installation, Wire Size and Terminal Torque

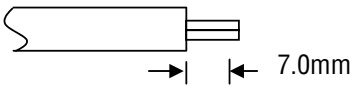
All interconnection wires between the drive, AC power source, motor, host control and any operator interface stations should be in metal conduits or shielded cable must be used. Use listed closed loop connectors that are of appropriate size for wire gauge being used. Connectors are to be installed using crimp tool specified by the manufacturer of the connector. Only Class 1 wiring should be used.

Table 4-2 Wire Size and Terminal Tightening Torque Specifications

Catalog Number	R, S, T Size		U, V, W Size		Ground Size		Terminal Screw Size	Screw Torque (Kgf. cm)/lb-in
	mm²	AWG	mm²	AWG	mm²	AWG		
VS1MD20P5	2	14	2	14	3.5	12	M3.5	10/8.7
VS1MD21	2	14	2	14	3.5	12	M3.5	10/8.7
VS1MD22	2	14	2	14	3.5	12	M3.5	10/8.7
VS1MD23	2	14	2	14	3.5	12	M4	15/13
VS1MD25	3.5	12	3.5	12	3.5	12	M4	15/13
VS1MD27	5.5	10	5.5	10	5.5	10	M5	32/28
VS1MD210	8	8	8	8	5.5	10	M5	32/28
VS1MD215	14	6	14	6	14	6	M6	30.7/26.6
VS1MD220	22	4	22	4	14	6	M6	30.7/26.6
VS1MD225	30	2	30	2	22	4	M8	30.6/26.5
VS1MD230	38	2	30	2	22	4	M8	30.6/26.5
VS1MD40P5	2	14	2	14	2	14	M3.5	10/8.7
VS1MD41	2	14	2	14	2	14	M3.5	10/8.7
VS1MD42	2	14	2	14	2	14	M4	15/13
VS1MD43	2	14	2	14	2	14	M4	15/13
VS1MD45	2	14	2	14	2	14	M4	15/13
VS1MD47	3.5	12	2	14	3.5	12	M5	32/28
VS1MD410	3.5	12	3.5	12	3.5	12	M5	32/28
VS1MD415	5.5	10	5.5	10	8	8	M5	30.7/26.6
VS1MD420	14	6	8	8	8	8	M5	30.7/26.6
VS1MD425	14	6	8	8	14	6	M6	30.6/26.5
VS1MD430	22	4	14	6	14	6	M6	30.6/26.5

* Strip the sheaths of the wire insulation 0.275 inches (7mm) when not using a ring terminal for the power connection.

Figure 4-3



*VS1MD225 and VS1MD230 are must use Ring or Fork Terminal certainly approved by UL.

4.5.1 Grounding Procedures

1. Remove covers. Cover removal is described in Chapter 3 of this manual.
2. Connect the power ground wire to the ground terminal (See Figure 4-4).
3. Connect the motor ground wire to the ground terminal (See Figure 4-4).

Figure 4-4 Power Terminal Locations

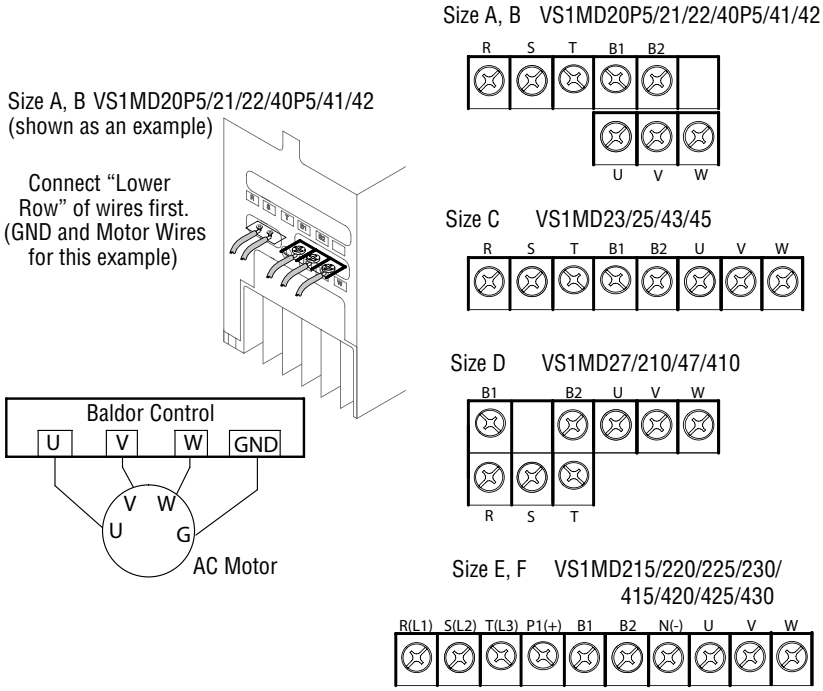

Size A, B VS1MD20P5/21/22/40P5/41/42
R S T B1 B2
U V W
Size A, B VS1MD20P5/21/22/40P5/41/42
(shown as an example)
Connect "Lower Row" of wires first. (GND and Motor Wires for this example)
Size C VS1MD23/25/43/45
R S T B1 B2 U V W
Size D VS1MD27/210/47/410
B1 B2 U V W
R S T
Baldor Control
U V W GND
V W
U G
AC Motor
Size E, F VS1MD215/220/225/230/
415/420/425/430
R(L1) S(L2) T(L3) P1(+) B1 B2 N(-) U V W

Table 4-3 Grounding Terminal Wire Specification

Inverter Capacity	200V Class			400V Class		
	Wire Size	Terminal Screw	Wire Size	Wire Size	Terminal Screw	Wire Size
0.5 to 5 Hp	12 AWG 3.5 mm^2	M3	Type 3	14 AWG 2.0 mm^2	M3	Special Type 3
7.5 to 10 Hp	10 AWG 5.5 mm^2	M4		12 AWG 3.5 mm^2	M4	
15 to 20 Hp	6 AWG 14.0 mm^2	M5		8 AWG 8.0 mm^2	M5	
25 to 30 Hp	4 AWG 22.0 mm^2	M6		6 AWG 14.0 mm^2	M5	

4.5.2 Motor Connections

All cables must be shielded and the shields must be grounded at the enclosure cable entrance.

1. Remove covers. Cover removal is described in Chapter 3 of this manual.
2. Connect the Motor leads to terminals U, V and W (see Figure 4-4 for location).

Long Motor Leads

For product of less than 5Hp (3.7kW), the wire length should be less than 328 feet (100m). When more than one motor is connected to the inverter, total wire length should be less than the maximum length. Do not use a 3wire cable for long distances.

For product of 5Hp or greater, total wire length should be less than 656 feet (200m). Due to increased leakage capacitance between wires, over-current protective feature may operate or equipment connected to the output side may malfunction. In case of long wire length, it is required that a lower carrier frequency be used or an Output Filter.

Length between Inverter and Motor	Up to 165 ft (50m)	Up to 328 ft (100m)	Up to 656 ft (200m), for 5Hp or greater drives only
Allowable Carrier Frequency	5 - 15kHz	2.5 - 5kHz	Less than 2.5kHz

Please note the ratings that can achieve 656 feet (200m) with a 2.5kHz or lower carrier frequency are only the 5 Hp to 30 Hp. Product less than 5Hp is rated to a maximum of 328 feet (100m) up to a 5kHz carrier frequency without the use of output reactors.

For long motor cable lengths in excess of those listed above, Baldor recommends adding an optional load reactor to the output of the control. The load reactor and/or common mode choke should be placed in close physical proximity to the control.

The wire leads that connect the motor to the control are critical in terms of sizing, shielding and the cable characteristics. Short cable runs are usually trouble free but fault-monitoring circuitry can produce numerous faults when long cables (over 100 feet) are used. 100+ ft (30m). Baldor recommends adding an optional load reactor to the output of the control. The load reactor and/or common mode choke should be placed in close physical proximity to the control.

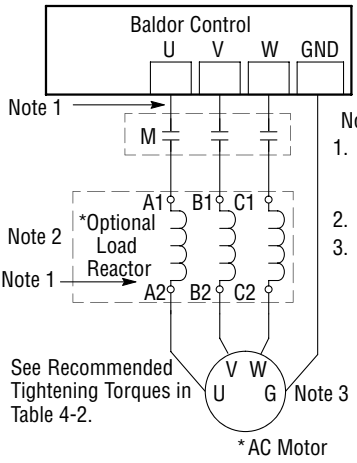
Unexpected faults may occur due to excessive charging current required for motor cable capacitance. If you use long motor leads and experience unexpected trips due to current overload conditions and are not sure how to correctly size and connect the optional load reactors, please contact your Baldor representative. Baldor is always glad to assist.

4.5.3 M-Contactor Connections

If required by local codes or for safety reasons, an M-Contactor (motor circuit contactor) may be installed. Incorrect installation or failure of the M-Contactor or wiring may damage the control. If an M-Contactor is installed, the control must be disabled for at least 200msec before the M-Contactor is opened or the control may be damaged. M-Contactor connections are shown in Figure 4-5.

CAUTION: **If an M-Contactor is installed, the control must be disabled for at least 200msec before the M-Contactor is opened. If the M-Contactor is opened while the control is supplying voltage and current to the motor, the control may be damaged. Before the control is enabled, the M-Contactor must be closed for at least 200msec.**

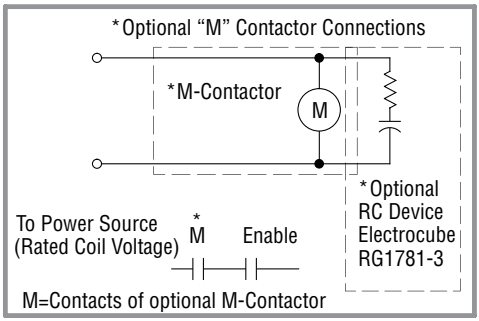
Figure 4-5 Motor Connections and Optional Connections



*Optional components not provided with control.

Notes:

1. Metal conduit should be used. Connect conduits so the use of Load Reactor or RC Device does not interrupt EMI/RFI shielding.
2. See Line/Load Reactors described previously in this section.
3. Use same gauge wire for ground as for U, V and W.



4.6 Input Power Connections

All cables must be shielded and the shields must be grounded at the enclosure cable entrance.

1. Connect the three phase input power wires to an appropriate interrupter and protection.
2. Connect the three phase AC input power leads to terminals R, S and T of the control (see Figure 4-2 for location).

4.7 Optional Dynamic Brake Hardware

If optional DB resistor is to be used, connect it to the B1 and B2 terminals, (see Figure 4-2). Dynamic Brake (DB) Hardware must be installed on a flat, non-flammable, vertical surface for effective cooling and operation.

5.1 Control Wiring Overview

VS1 Analog and Digital input and output connections are made at the Control Terminals shown in Figure 5-1. These terminals are described in Table 5-1.
Control wire connections must be made using shielded twisted pair #18 AWG (0.8mm2) wire minimum. The cable must also have an overall shield and not exceed 100 feet (30m) in length. Control wire cables must be separated from power wiring. Separate parallel runs of control cables and power cables by at least 3". Cross power wires at right angles only. Insulate or tape ungrounded end of shields to prevent contact with other conductors or ground.

Figure 5-1 Control Wiring Terminal Strips

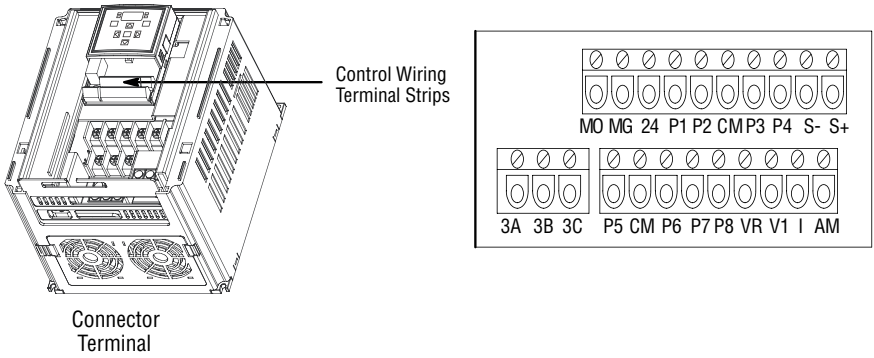


Table 5-1 Control Terminal Descriptions

Connector Terminal	Signal Description
MO	Digital Output + (Open Collector)
MG	Digital Output - (Common)
24	Internal 24VDC power (powers P1-P8 inputs)
P1	Forward Run (Programmable, assignable)
P2	Reverse Run (Programmable, assignable)
CM	Internal 24V Common (return for P1-P5 and AM inputs)
P3	Output Inhibit (Programmable, assignable)
P4	Fault Reset (Programmable, assignable)
P5	Jog Operation (Programmable, assignable)
P6	Speed Select 1 (Programmable, assignable)
P7	Speed Select 2 (Programmable, assignable)
P8	Speed Select 3 (Programmable, assignable)
VR	12V power supply for speed reference potentiometer
V1	0-10VDC Analog Input Terminal

Table 5-1 Control Terminal Descriptions Continued

Connector Terminal	Signal Description
I	0-20mA Analog Input Terminal
AM	0-10VDC Analog Output Terminal (Programmable, assignable)
3A	Relay Output - A Contact (Normally Open) (Programmable, assignable)
3B	Relay Output - B Contact (Normally Closed) (Programmable, assignable)
3C	Common -3A, 3B Contacts
S+	Data + RS485 Communication Terminal
S-	Data - RS485 Communication Terminal

5.2 Control Input Connections

Determine if you will use NPN (factory setting) or PNP connections. For NPN, CM (Common or ground) is used to switch the input signals. For PNP, 24 (+24VDC output) is used to switch the input signals.

1. Set the NPN/PNP switch to the desired position.
2. **For NPN Connections**
   Connect the Digital Inputs to one pole of a switch and the other switch pole to CM.
   An active low at P1 - P8 will activate the inputs.
   For PNP Connections
   Connect the Digital Inputs to one pole of a switch and the other switch pole to 24. An active High at P1 - P8 will activate the inputs.
3. The speed Command input can be either a Voltage (0-10VDC) or a Current (0-20mA) input. For Voltage input, either an external potentiometer or an external voltage reference can be used.
   a. For an External reference voltage input, connect the 0-10VDC input to the VI terminal. Connect the reference from the external source to the CM terminal.
   b. For an external potentiometer, connect the pot as shown, one end to VR terminal, the wiper to VI terminal and the other end to CM terminal.

For Current input, connect the 0-20mA source to the I terminal, the reference to CM terminal.

Figure 5-2 Control Terminal Specifications

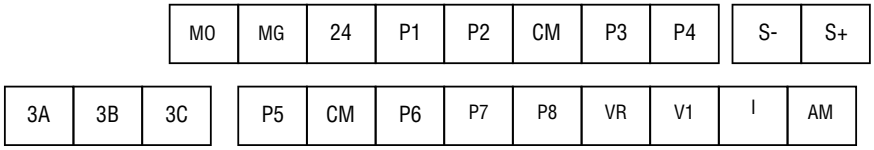


Table 5-2 Wire Sizes

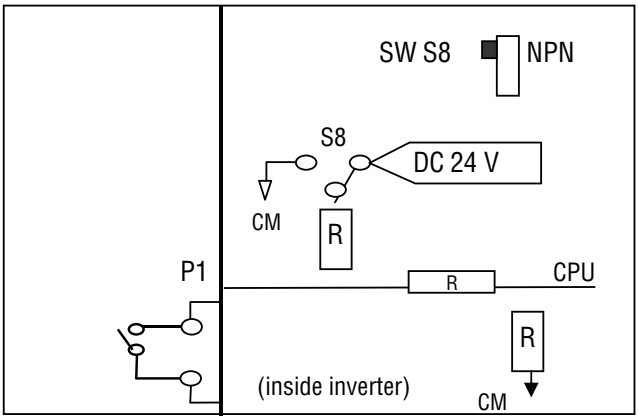
T/M	Wire Size AWG (mm2)		Screw Size	Torque Lb-in (Nm)	Specifications
	Single Wire	Stranded			
P1 to P8	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	
CM	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	
VR	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Output Voltage: 12V Max output current: 10mA Potentiometer: 1 to 5kohm
V1	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Max input voltage: -12V to +12V input
I	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	0 to 20mA input internal resistor: 250 ohm
AM	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Max output voltage: 11[V] Max output current: 10mA
MO	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Below DC 26V, 100mA
MG	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	
24	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Max output current: 100mA
3A	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Below AC 250V, 1A
3B	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	Below DC 30V, 1A
3C	17 (1.0)	16 (1.5)	M2.6	3.48 (0.4)	

Notes:

1. Tie the control wires more than 5.9 inches (15cm) away from the control terminals. Otherwise, the terminals will interfere with the front cover reinstallation.
2. Use Copper wires rated 600V, 75°C and higher.
3. Use the recommended tightening torque when securing terminal screws.
4. When using an external power supply (24V) for multi-function input terminal (P1 to P8), terminals will be active above 12V level. Take caution not to drop the voltage below 12V.

Figure 5-3 PNP/NPN Selection and Connection

When using DC 24V inside the drive (NPN)



When using an external 24V DC supply (PNP)

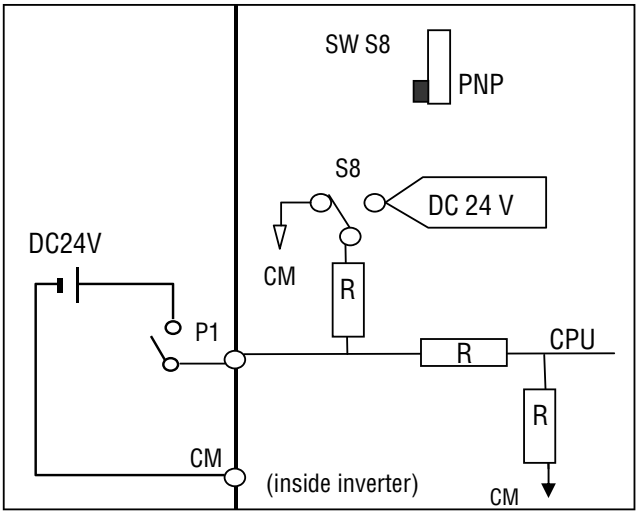
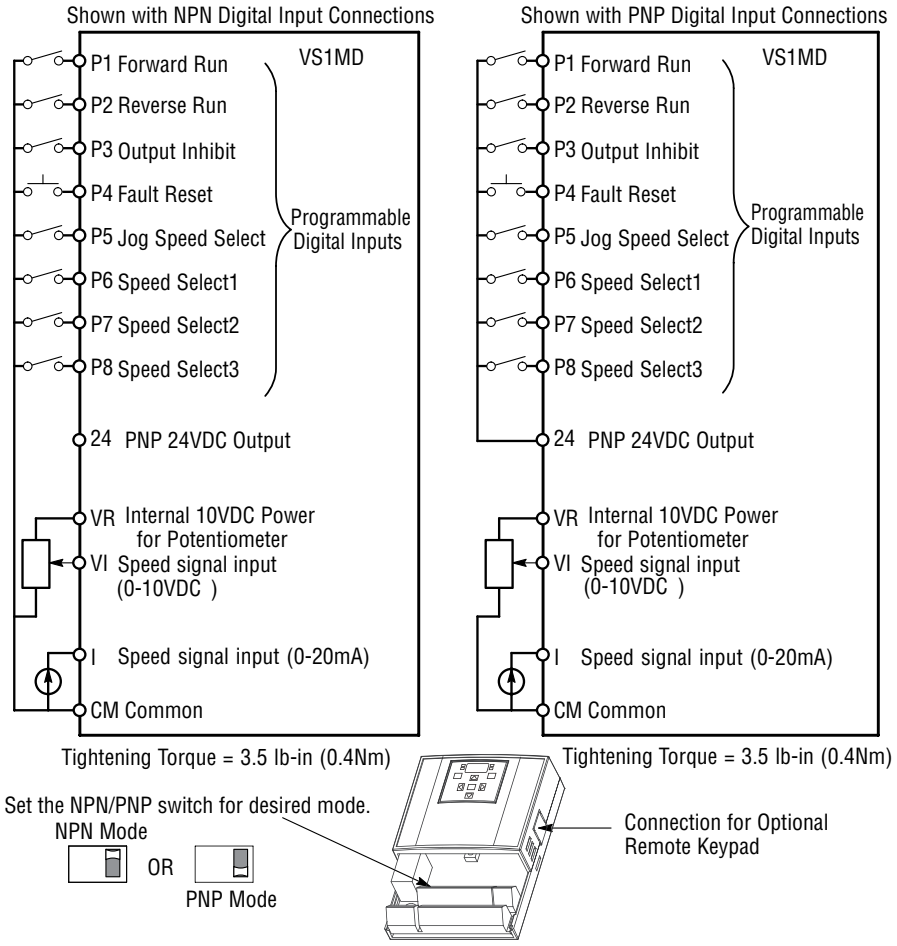


Figure 5-4 Input Connections 2Wire Start

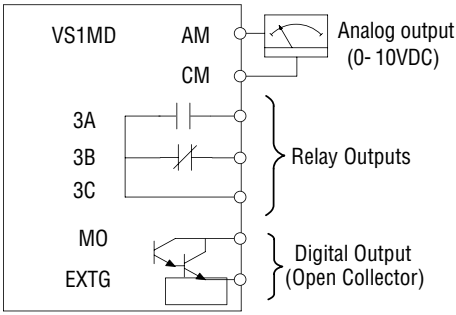


5.3 Control Output Connections

The Analog and Digital outputs are shown in Figure 5-5.

1. Connect an external analog output device to AM terminal and it's reference to CM.
2. The normally Open and Closed relay outputs can be connected to an external device, terminal 3C is the common terminal.
3. The open collector digital output can drive a digital load, connect to MO and EXTG.

Figure 5-5 Output Connections



Tightening Torque = 3.5 lb-in (0.4Nm)

Chapter 6

Using the Keypad

6.1 Keypad Overview

This chapter provides an overview of the integrated keypad and how to use it to program the VS1MD drive. Factory settings of parameter values allow the drive to be controlled from the integral keypad. The keypad is shown in Figure 6-1 and described in Table 6-1.

Figure 6-1 Keypad Components

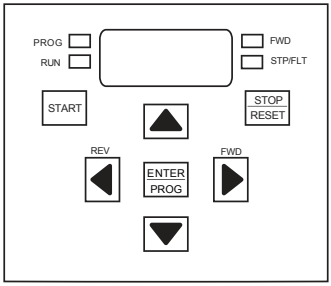


Table 6-1 Key Descriptions

Key	Name	Description
START	Start Key	Starts the drive. Active when the input mode is programmed for keypad control.
STOP / RESET	Stop Key	Stops the drive in the programmed stop mode. Always active. Resets active faults after fault is cleared.
ENTER / PROG	Enter/ Prog	Accesses programming menu and locks in Changed values. To enter programming mode, the Enter/Prog key must be held for 2 seconds. Holding the Enter/Prog key for 2 seconds or more will escape back to Control Reference Mode or back out of a parameter edit function.
▲ ▼	Up/Down Arrow	**Operation Mode:** Changes the commanded speed reference. Only active when the input mode is programmed for keypad control. The Up-Arrow increases the speed reference at a controlled rate. The Down-Arrow decreases the speed reference at a controlled rate. Holding either arrow for a set period of time increases the reference ramp rate. **Program Mode:** Increment/Decrement parameter numbers.
REV ◀ FWD ▶	Left/Right Arrow	**Operation Mode:** Only active when the input mode is programmed for keypad control. Direction keys are active only when operating in reference command mode. Reverse may be disabled by a parameter. **Program Mode:** Cycle through the parameter groups or shift to the next digit to be changed (while in the parameter edit mode).

The LEDs display status information as described in Table 6-2.

Table 6-2 LED Descriptions

LED	LED Status	Description
Prog	Steady ON (Red)	Drive is in Programming Mode.
	Off	Drive is in Operational Mode.
Run	Steady ON (Red)	Drive is running at commanded Speed.
	Flashing (Red)	Drive is accelerating/decelerating to new speed setting.
	Off	Drive is not running.
FWD	Steady ON (Red)	Drive is in Forward operation.
	Off	Drive is in Reverse operation.
STP/FLT	Steady ON (Red)	Drive is Stopped.
	Flashing (Red)	Drive is in Fault condition.
	Off	Drive is running.

6.2 Parameter Overview

To program the drive for a specific application, you adjust the appropriate parameters. Parameters define characteristics of the drive. A list of all parameters is provided in Chapter 7 of this manual. There are three types of parameters:

1. **Numbered List Parameters** (Enumerated Parameters)
   Numbered list parameters allow a selection from two or more options. Each item is represented by a parameter number.
   Example: Start/Stop Source (P38)

2. **Bit Parameters**
   Bit parameters have individual bits associated with features or conditions. If the bit is 0, the feature is off or the condition is false. If the bit is 1, the feature is on or the condition is true.
   Example: Terminal Status Display (d7)

3. **Numeric Parameters**
   These parameters have a single numerical value (for example, 0.1 volts).
   Example: Motor Rated Current (P32)

Parameters are also either configurable or tunable, or read-only.
Configurable parameters can be adjusted or changed only while the drive is stopped.
Tunable parameters can be adjusted or changed while the drive is running or stopped.
Read-only parameters cannot be adjusted.

6.2.1 Parameter Organization

Parameters are organized into five Parameter Groups:

1. **Display Group**
   Parameters for the display of basic drive information.
2. **Programming Group**
   Most commonly used parameters for start-up and operation.
3. **Terminal Group**
   Input and output control parameters.
4. **Function Group 1**
   Advanced motor control parameters.
5. **Function Group 2**
   Advanced motor profile parameters.

These groups are shown in Figure 6-2 and navigation between groups and between parameters within a group is also shown.

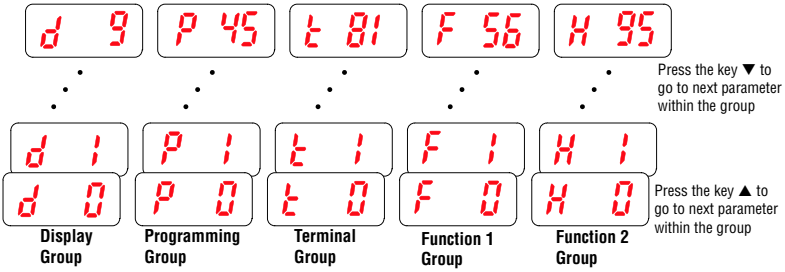
6.2.2 Navigation between and within Parameter Groups

Use this procedure to enter the programming mode and to move between groups.

Table 6-3

Action	Description	Display	Comments
Apply Power	Power on display shows drive status. Motor speed is 0.00		
Press and hold the "Enter/Prog" key for at least two seconds to navigate from the power on display to the Programming Group.	The "PROG" LED illuminates and the drive is in programming mode. The first parameter in the Display Group is displayed.		Press the key to go to d1, d2 etc. within the Drive group. Press Enter/Prog to select the parameter and view the parameter value.
Press the ▶ key to display the first code in Programming Group.	The "PROG" LED remains on.		The first parameter in the Programming Group is displayed.
Press the ▶ key to display the first code in Terminal Group.	The "PROG" LED remains on.		The first parameter in the Terminal Group is displayed.
Press the ▶ key to display the first code in Function Group 1.	The "PROG" LED remains on.		The first parameter in the Function Group 1 is displayed.
Press the ▶ key to display the first code in Function Group 2.			The first parameter in the Function Group 2 is displayed.
Press the ▶ key to navigate to the next group which returns to the Display Group.			Press Enter/Prog for 2 seconds to return to the display mode.

Figure 6-2 Parameter Group Organization



Press the ▶ key to navigate to the next group. Press the ◀ key to navigate to the previous group.

Change Motor Current Value: Use this procedure to enter the Motor Rated Current value.

Table 6-4 Change Motor Current Value

Action	Description	Display	Comments
Apply Power	Power on display shows drive status. Motor speed is 0.00	0.00	
Press and hold the "Enter/Prog" key for at least two seconds to navigate from the power on display to the Programming Group.	The "PROG" LED illuminates and the drive is in programming mode. The first parameter in the Display Group is displayed.	d 0	The first parameter in the Display Group is displayed.
Press the ▶ key to display the first code in Programming Group.		P 0	The first parameter in the Programming Group is displayed.
Press Enter/Prog to set the jump code.	The initial value of the parameter is displayed.	34	Press the ▼ key to decrease the value to 32. Press Enter/Prog when finished.
Press Enter/Prog to view the value of Motor Rated Current value (P32).		P 32	The first parameter in the Programming Group is displayed.
Press Enter/Prog to set the jump code.	The initial value of the parameter is displayed.	1.5	Press the ▼▲ keys to increase or decrease the Left digit of the parameter value.
Press the ◀ key to edit the left digit.		1.5	Press the ▼▲ keys to increase or decrease the Left digit value. Press Enter/Prog when finished.
		P 32	

Read Parameter Value: Use this procedure to read values of Display Parameters (these values cannot be changed, they are read only).

Table 6-5 Read Parameter Value

Action	Description	Display	Comments
Apply Power	Power on display shows drive status. Motor speed is 0.00		
Press and hold the "Enter/Prog" key for at least two seconds to navigate from the power on display to the Programming Group.	The "PROG" LED illuminates and the drive is in programming mode. The first parameter in the Display Group is displayed.		The first parameter in the Display Group is displayed.
Press the ▲ key twice to change the d2 parameter.			
Press "Enter/Prog" key to display the value of parameter d2.			Displays the value of parameter d2 (Motor Current).
Press "Enter/Prog" key to return to previous display.			

Jump to Parameter Number: To jump to parameter P45, do the following:

Table 6-6 Jump to Parameter Number

Action	Description	Display	Comments
Apply Power	Power on display shows drive status. Motor speed is 0.00		
Press and hold the "Enter/Prog" key for at least two seconds to navigate from the power on display to the Programming Group.	The "PROG" LED illuminates and the drive is in programming mode. The first parameter in the Display Group is displayed.		The first parameter in the Display Group is displayed.
Press the ▶ key to display the first code in Programming Group.			The first parameter in the Programming Group is displayed.
Press the ▶ key to display the first code in Programming Group.			Press the ▲ key to increase the right digit to a value of 5.
Press the ◀ key to edit the left digit.			Press the ▲ key to increase the light digit to a value of 4.
Press Enter/Prog to jump to parameter P45.			Press the ▲ key to increase the left digit to a value of 4. Press Enter/Prog when finished.
Press Enter/Prog once again to view the value of P45.			The first parameter in the Programming Group is displayed. Press Enter/Prog when finished.
Press the ▶ key to display the first code in Programming Group.			The first parameter in the Programming Group is displayed.

Fault Status: When a fault is active, the STOP/FAULT LED will flash. This procedure is used to review the active fault as well as the conditions at the time the fault occurred.

Table 6-7 Fault Status

Action	Description	Display	Comments
When an overcurrent condition has occurred, a fault will be latched and the display will show the condition.	The Over Current Trip is displayed.		
Press Enter/Prog to review the Fault Conditions.	First is the frequency (Speed) at which the fault occurred.		This example indicates that the drive was at 30.00 Hz when the fault occurred.
Press the ▲ key to view the next status value.	The output current during the fault is next.		This example indicates that the drive was outputting 5.0 Amps when the fault occurred.
Press the ▲ key to view the next status value.	The operating status of the drive when the fault occurred is next.		This example indicates that the drive was accelerating when the fault occurred.
Press the “STOP/RESET” key to reset the fault.	The display will indicate that there is no longer a fault condition.		The STP/FLT LED will be on solid indicating that the fault is cleared and that the drive is in the stopped condition.

Restore Factory Settings: This procedure restores all parameter values to the original factory setting.

Table 6-8 Restore Factory Settings

Action	Description	Display	Comments
Apply Power	Power on display shows drive status. Motor speed is 0.00		
Press and hold the "Enter/ Prog" key for at least two seconds to navigate from the power on display to the Programming Group.	The "PROG" LED illuminates and the drive is in programming mode. The first parameter in the Drive Group is displayed.		The first parameter in the Drive Group is displayed.
Press the ▶ key four times to display Function Group 2.			
Press Enter/Prog to set the jump code. The Restore Factory Settings parameter number is H93.	The initial value of the parameter is displayed.		Press the ▼ key to decrease the value to 3.
Press the ◀ key to shift left one digit and enter 9.			Press the ▲ key to increase the value of 9. Press Enter/ Prog when finished.
Press Enter/Prog to display the value of H93.			
Press Enter/Prog to display the value of H93.			Press the ▲ key to increase the value to 1. Press Enter/ Prog to reset all.
Factory settings will be restored.			Press the ▼ key to decrease the value to 0. Press Enter/ Prog to exit.

6.3 Password Registration

Table 6-9 Password Registration

Group	Code	Parameter Name	Setting	Unit
Function Group 2	H94	[Password Registration]	-	
	H95	[Parameter Lock]	-	
Register password for Parameter lock (H95). Password is Hex characters 0 to 9, A, B, C, D, E and F.				

Factory default password is 0. Enter any new password except 0.
Do not forget the registered password. It is needed to unlock parameters.

Registering the password for the first time.
Step 1. Move to H94 code. H94 will be displayed.
Step 2. Press Enter key twice. 0 will be displayed.
Step 3. Register password. (Ex: 123) 123 will be displayed.
Step 4. 123 will blink when Enter key is pressed. 123 will be displayed.
Step 5. Press Enter key. H94 will be displayed after the new password has been registered.
Changing password. (Current PW: 123 -> New PW: 456)
Step 1. Move to H94 code. H94 will be displayed.
Step 2. Press Enter key. 0 will be displayed.
Step 3. Enter any number (e.g.: 122). 122 will be displayed.
Step 4. Press the Enter key. 0 is displayed because wrong value was entered.
Password cannot be changed in this status. 0 will be displayed.
Step 5. Enter the right password. 123 will be displayed.
Step 6. Press Enter key. 123 will be displayed.
Step 7. Enter the new password. (e.g. 456). 456 will be displayed.
Step 8. Press the Enter key. Then 456 will blink. 456 will be displayed.
Step 9. Press Enter key. H94 will be displayed.

6.4 Powerup Procedure

1. Remove all power from the control.
2. Couple the motor to its load.
3. Verify freedom of motion of motor shaft.
4. Verify the motor coupling is tight without backlash.
5. Verify the holding brakes if any, are properly adjusted to fully release and set to the desired torque.
6. Connect power and motor.
7. Connect Input Control wires.
8. Turn power on. Be sure there are no faults.
9. Set the following parameters for the values displayed on the motor nameplate:
   P30 Motor HP Select
   P32 Motor Rated Current
   P33 Pole Number
   P34 Base Frequency
10. If external dynamic brake hardware is used, set the Level 2 Brake Adjust block “Resistor Ohms” and “Resistor Watts” parameters.
11. Run the drive from the keypad.
12. Select and program additional parameters to suit your application, see Chapter 8.

The control is now ready for use the in keypad mode. If a different operating mode is desired, refer to Chapter 7 Parameter Descriptions and Chapter 8 Customizing for your Application.

Basic drive defaults to V/Hz control. Refer to Section 8.5 and 8.6 for Sensorless Vector operation.

6.5 Keypad Frequency Setting

Table 6-10 Keypad Frequency Setting

Group	Code	Parameter Name	Setting	Unit
Display Group	P37	[Frequency Command]	-	Hz
	P40	[Frequency Setting Method]	1	
Step 1. Set P40 [Frequency Setting Method] = 1. Step 2. Set the desired frequency in P37 and press the Prog/Ent key to save the value into memory. Step 3. The value can not be set above P36 [Frequency High Limit].				

Note: When remote keypad is connected, keypad keys on the body are deactivated.

7.1 Overview

Parameters are organized into five Parameter Groups:

1. **Display Group**
   Parameters for the display of basic drive information.

2. **Programming Group**
   Most commonly used parameters for start-up and operation.

3. **Terminal Group**
   Input and output control parameters.

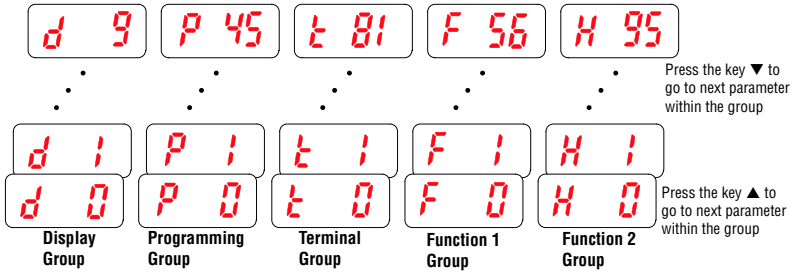
4. **Function Group 1**
   Advanced motor control parameters.

5. **Function Group 2**
   Advanced motor profile parameters.

For each parameter described in this chapter, the following terms may be used:

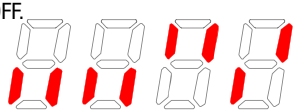
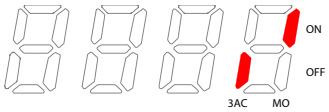
Parameter Number:	Unique number assigned to each parameter.
Parameter Name:	Unique name assigned to each parameter.
LED Display:	Display shown on LED screen when parameter is accessed.
Range:	Predefined parameter limits or selections. Note that a negative Hz value indicates reverse rotation.
Preset Value:	Factory preset value.
Access:	RO - Read Only. Parameter value can not be modified by user. R/W - Configurable. Parameter can be modified only while drive is stopped. Tune -Tunable. Parameter can be modified while drive is running or stopped.
Group:	Menu group within which parameter is located.
See also:	Associated parameters that may provide additional or related information.

Figure 7-1 Parameter Group Organization and Navigation



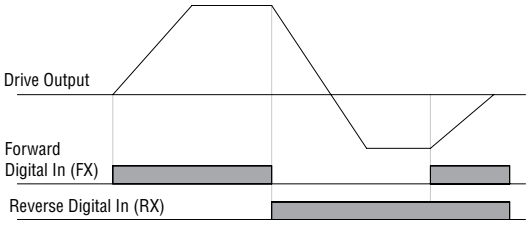
7.2 Display Group

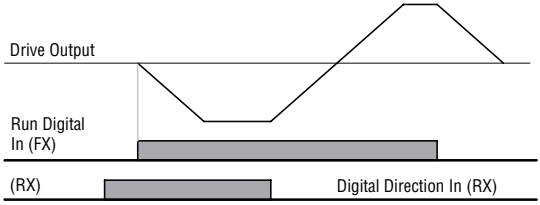
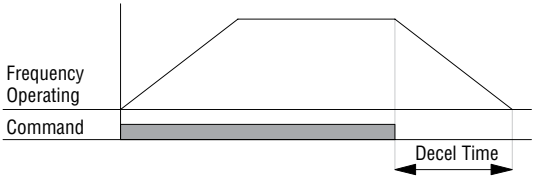
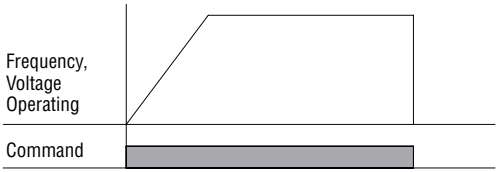
Group	Number Selection	Description
Display	**d0**	**Frequency Command** Access: RO Default: N/A Range: 0.00 - Frequency High Limit (P36) Hz
		The value of the active frequency command. The commanded frequency is displayed even if the drive is not running.
		See Also: N/A
	d1	**Motor RPM** Access: RO Default: N/A Range: 0 Motor RPM (based on P33 Motor Poles)
		The output motor RPM. Motor RPM is scaled based on output frequency present on terminals U, V, and W based on the setting in P33 - Motor Poles.
		See Also: N/A
	d2	**Output Current** Access: RO Default: N/A Range: 0.00 - Motor Rated Current (P32) Amps
		The value of the output current present at terminals U, V, and W.
		See Also: N/A
	d3	**Output Voltage** Access: RO Default: N/A Range: 0.00 - Drive Rated Voltage VAC
		The output voltage present at U, V, and W.
		See Also: N/A
	d4	**Output Power** Access: RO Default: N/A Range: 0.00 - (Drive Rated Power x 2) kW
		The motor power applied to terminals U, V, and W.
		See Also: N/A
	d5	**Output Torque** Access: RO Default: N/A Range: 0.00 - (Drive Rated Torque x 2) [kgf/M]
		The value of the output torque present at terminals U, V, and W. (Enter the motor nameplate efficiency in H36 to display correct torque.)
		See Also: N/A
	d6	**DC Link Voltage** Access: RO Default: N/A Range: Based on Drive Rating VDC
		The present DC bus voltage level.
		See Also: N/A

Group	Number Selection	Description
Display (Cont.)	**d7**	**Input Terminal Status Display** Access: RO Default: N/A Range: N/A
		Displays of P1-P8 input terminal status. This example shows P1, P3, P4 are ON and P2, P5 are OFF. 
		See Also: N/A
	d8	**Output Terminal Status Display** Access: RO Default: N/A Range: N/A
		Displays status of the Digital (MO) Output and the Relay (3A-C) terminals. This example shows Digital Output (MO) is ON and the Relay is OFF. 
		See Also: N/A
	d9	**Software Version** Access: RO Default: N/A Range: 1.0 - 99.9
		The version of the Main Control Board software.
		See Also: N/A
	d10	**PID Control Feedback Amount** Access: RO Default: N/ARange: N/A
		Displays PID Feedback Level
		See Also: N/A
	nOn	**Current Fault Display** Access: RO Default: N/A Range: N/A
		Displays the types of faults, frequency and operating status at the time of the last fault. Fault code can be viewed in parameters H1-H5. H6 is used to clear the fault code history.
		See Also: H1-H6. See Chapter 9 for additional information.

7.3 Programming Group

Group	Number Selection	Description
Programming	**P0**	**Jump Code** Access: Tune Default: 30 Range: 30 - 99
		Sets the parameter number to jump directly to. Jump must be within the group.
		See Also: N/A
	P30	**Motor HP Select** Access: R/W Default: Based on drive rating Range: 0.5 - 30
	0.5	0.5 HP
	1	1 HP
	2	2 HP
	3	3 HP
	5	5 HP
	7.5	7.5 HP
	10	10 HP
	15	15 HP
	20	20 HP
	25	25 HP
	30	30 HP
		Sets the motor type connected to the drive output.
		See Also: P32, P34
	P32	**Motor Rated Current** Access: R/W Default: Based on drive rating Range: 0.5 - 50 Amps
		Sets the value of motor rated current on the nameplate.
		See Also: P30, P32, P34
	P33	**Pole Number** Access: R/W Default: 4 Range: 2, 4, 6, 8, 10, 12
		Sets the number of motor poles.
		See Also: P30, P32, P34
	P34	**Base Frequency** Access: R/W Default: 60.00 Range: 30 - 400 Hz
		The drive outputs its rated voltage to the motor at this frequency (enter motor nameplate).
		See Also: P30, P33, F30-F38. See parameter F30 for custom V/Hz settings and V/Hz curve.

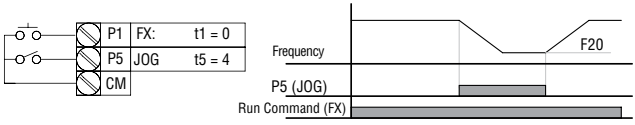
Group	Number Selection	Description
Programming (Cont.)	**P35**	**Frequency Low Limit** Access: R/W Default: 10.00 Range: 0 - P36 Hz
		Sets drive minimum steady state output frequency.
		Sets Also: P36, F30-F38
	P36	**Frequency High Limit** Access: R/W Default: 60.00 Range: 0 -400 Hz
		Sets drive maximum steady state output frequency.
		See Also: P35
	P37	**Speed Command** Access: Tune Default: 0.00 Range: 0 - 400 Hz
		Sets the frequency (speed) that the drive is commanded to output. If the drive is running when the value is changed, it will immediately accelerate or decelerate to this value after Enter/Prog is pressed.
		See Also: N/A
	P38	**Start/Stop Source** Access: R/W Default: 0 Range: 0 - 4
	0	Keypad (Drive control for start, stop, forward and reverse are from drive keypad.)
	1	Terminal Mode 1 (2Wire or 3Wire control from run forward terminal and run reverse terminal.)
	2	Terminal Mode 2 (2Wire with direction switch from run terminal and directional terminal.)
	3	RS485 Communication Drive operation controlled using RS485 communications (See Appendix E)
	4	Communication Module (Drive operation controlled from optional communication card.)
		Sets the input source that is used to start and stop the drive. Terminal Operation Mode 1: (2Wire or 3Wire Control Fwd/Rev): • Select one digit input (t1-t8) = 0, run forward (FX). • Select one digit input (t1-t8) = 1, run reverse (RX). • To enable 3Wire control select one digit input (t1-t8) = 17, 3Wire operation. • Drive stops when both inputs are off or when both are on. 

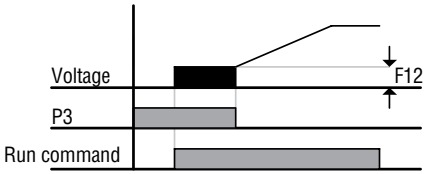
Group	Number Selection	Description
Programming (Cont.)	**P38 (Cont.)**	Terminal Operation Mode 2: (2Wire Control Fwd/Rev Switch): • Select one digit input (t1-t8) = 0, run forward (FX). Operates as a run command. • Select one digit input (t1-t8) = 1, run reverse (RX). Operates as a Direction Switch. • Drive stops when run input is off. 
		See Also: P40; t1 - t8
	P39	**Stop Type** Access: R/W Default: 0 Range: 0 - 3
	0	Decelerate to Stop (Ramp). Motor decelerates to 0 Hz and stops during the set time. 
	1	DC Brake to Stop. See parameters F8-F11 for further details.
	2	Coast to Stop. Output frequency and voltage are shut down on a stop command. 
	3	Power Braking. Drive uses energy stored in the motor to stop the load in the case of an input power loss.
		Sets the active mode for all stop sources.
		See Also: P38, P42, F8-F11

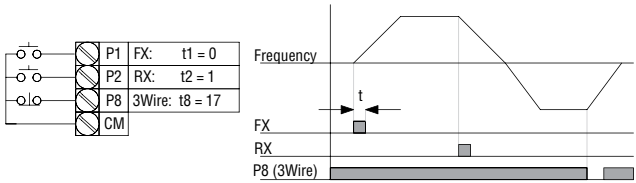
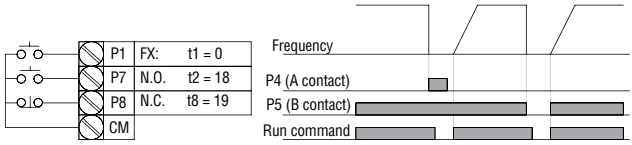
Group	Number Selection	Description
Programming (Cont.)	**P40**	**Speed Reference Source** Access: R/W Default: 1 Range: 1 - 9
	1	Digital Keypad Output frequency is set to the operation mode by pressing the up/down keys. The drive immediately responds to the new setting without pressing the enter key.
	2	Analog V1 1:+/- 10V Output frequency is set by a +/- 10V signal applied to an analog input terminal V1.
	3	Analog V1 2: 0 - 10V Output frequency is set by a 0-10VDC signal applied to an analog input terminal V1.
	4	Analog Terminal I: 0 - 20mA Output frequency is set by a 0-20mA signal applied to analog input terminal I.
	5	Analog Terminal V1 Mode 1+ Terminal I Output frequency is set by the sum of the +/- 10V signal applied to V1 and the 0-20mA applied to Terminal I.
	6	Analog Terminal VI Mode 1+ Terminal I Output frequency is set by the sum of the 0-10V signal applied to V1 and the 0-20mA applied to Terminal I.
	7	Analog RS485 Drive output frequency is controlled by the RS485 communications port.
	8	MOP Reference Drive output frequency controlled by digital Up/Down commands.
	9	Communication Module Drive output frequency controlled by optional communication card.
		Sets the source of the speed reference to the drive.
		See Also: t32-t33, F60
	P41	**Accel Time** Access: Tune Default: 5.0 Range: 0 - 6,000 sec
		Sets the Accel Time of the drive. When using multiple accel/decel curves with preset speeds, this ramp serves as accel/decel time 0. H71 can be used to scale the accel/decel units and H70 determines if the time to accel/decel is relative to P35 (Frequency High Limit) or the delta change of running frequency to set frequency.
		See Also: P42, P36, H70, H71
	P42	**Decel Time** Access: Tune Default: 10.0 Range: 0 - 6,000 sec
		Sets the Decel Time of the drive. When using multiple accel/decel curves with preset speeds, this ramp serves as accel/decel time 0. H71 can be used to scale the accel/decel units and H70 determines if the time to accel/decel is relative to P35 (Frequency High Limit) or the delta change of running frequency to set frequency.
		See Also: P41, P36, H61, H70, H71

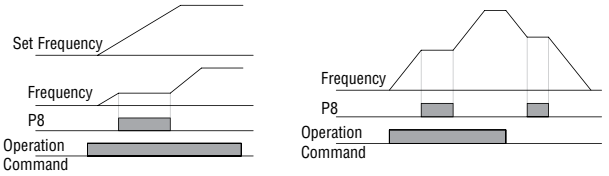
Group	Number Selection	Description
Programming (Cont.)	**P43**	**Preset Speed 1** Access: Tune Default: 10.0 Range: 0 - 400 Hz
		Provides an internal fixed speed command selectable by digital inputs.
		See Also: t1-t8, t10-t27
	P44	**Preset Speed 2** Access: Tune Default: 20.0 Range: 0 - 400 Hz
		Provides an internal fixed speed command selectable by digital inputs.
		See Also: t1-t8, t10-t27
	P45	**Preset Speed 3** Access: Tune Default: 30.0 Range: 0 - 400 Hz
		Provides an internal fixed speed command selectable by digital inputs.
		See Also: t1-t8, t10-t27
	P46	**Drive Start/Stop Source 2** Access: R/W Default: 1 = Terminal Mode 1 Range: 0 - 4 (Refer to table for P38)
		This parameter serves as an alternate control mode. It is selectable by a digital input (t1-t8) = “22”. Only viewable when one of the t1-t8 terminals is set for 22.
		See Also: P38, t1-t8
	P47	**Speed Reference Source 2** Access: R/W Default: 1 = Keypad Range: 1- 8 (Refer to Table for P40)
		This parameter serves as an alternate speed reference mode. It is selectable by a digital input (t1-t8) = “22”. Only viewable when one of the t1-t8 terminals is set for 22.
		See Also: P40, P47, t1-t8
	P48	**PID Control Setpoint** Access: Tune Default: 0 or 0.00% Range: 0 - 400.00 Hz or 0 - 100.00%
		PID Control standard value setting, the internal setpoint in percent or hertz.
		See Also: N/A

7.4 Terminal Group

Group	Number Selection	Description
Terminal	**t0**	**Jump Code** Access: Tune Default: 1 Range: 0 - 99
		Sets the parameter number to jump directly to. Jump must be within the group.
		See Also: N/A
	t1	**Digital Input 1-8 Define** Default: 0 Access: Tune
	t2	Default: 1 Access: Tune
	t3	Default: 2 Access: Tune
	t4	Default: 3 Access: Tune
	t5	Default: 4 Access: Tune
	t6	Default: 5 Access: Tune
	t7	Default: 6 Access: Tune
	t8	Default: 7 Access: Tune
	0	Forward Run (FX) Command Defines a digital input as a forward run command in 2Wire or 3Wire control. For both 2Wire and 3Wire control, P38 Drive Mode should be set to 1 for normal operation. For 3Wire control an additional terminal must be defined as 17=3Wire Operation.
	1	Reverse Run (RX) Command Defines a digital input as a reverse run command in 2Wire or 3Wire control. For both 2Wire and 3Wire control, P38 - Drive Mode should be set to a 1 for normal operation. For 3Wire control an additional terminal must be defined as 17 = 3Wire operation.
	2	Output Inhibit Defines a digital input as a drive Output Inhibit. As soon as this input is closed, the drive output is instantly turned off and the motor will free wheel (coast to a rest). As soon as the input is opened, the drive will resume previous operation (if in run, the drive will immediately accelerate to the set speed). While the input is closed the drive display will show ESt [Instant Cut Off].
	3	Fault Reset (RST) Active input resets the fault and resets the drive.
	4	Jog When active, the drive ramps to the value set in Jog Frequency (F20). Jog operation overrides all other operations except Dwell operation. If Jog Speed Command is entered during a Preset Speed, Up-Down or 2Wire control; operation is executed at Jog frequency, see Figure 7-2. A valid start command is required separate from the dedicated jog input. The jog function is only available for 2Wire control. **Figure 7-2 Jog** 

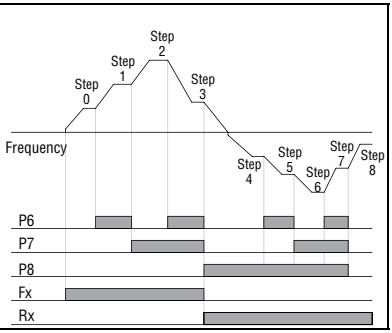
Group	Number Selection	Description
Terminal (Cont.)	**t1-t8 (cont)**	**Digital Input 1-8 Define (cont.)**
	5	Speed Select 1 - See Figure 7-7
	6	Speed Select 2 - See Figure 7-7
	7	Speed Select 3 - See Figure 7-7 Used to select Preset Speed 1 - 7 combinations, see P43-P45 and t10-t13, and Figure 7-7.
	8	Ramp Select 1 - See Figure 7-8
	9	Ramp Select 2 - See Figure 7-8
	10	Ramp Select 3 - See Figure 7-8 Used to define accel/decel ramp combinations for preset speeds, see t14-t27.
	11	DC brake during start DC voltage will be applied to the motor windings at a level set by DC Brake Start Voltage (F12) for as long as the digital input is closed. See also F12 and F13 - Starting DC brake parameters. **Figure 7-3 DC Brake During Stop** 
	12	2nd motor select When input is present, the drive configures itself for a second set of motor settings defined in 2nd motor operation parameters (H81 to H90).
	13	Timer Maintained Runs the timer as long as the digital input is maintained.
	14	Timer Momentary Starts the timer on a momentary input.
	15	Frequency increase (UP) Increases the frequency reference to the drive after a run command. Frequency is saved to parameter F64 on a stop command if F63 = 1 `save up/ down frequency'.
	16	Frequency decrease (DOWN) Decreases the frequency reference to the drive after a run command. Frequency is saved to parameter F64 on a stop command if F63 = 1 `save up/ down frequency'.

Group	Number Selection	Description
Terminal (Cont.)	**t1-t8 (cont)**	**Digital Input 1-8 Define (cont.)**
	17	3Wire operation Select to define a digital input for 3Wire control. Inputs defined as forward (FX) and reverse (RX) are momentary inputs and opening the input defined as 3Wire operation will stop the drive. For both 2Wire and 3Wire control, P38 - Drive Mode should be set to a 1 for normal operation. **Figure 7-4 3Wire Operation** 
	18	External trip - A (N.O.) Normally open contact input. When a digital input is set to “Ext trip-A” is ON (Closed), the drive displays the fault and turns off its output power. See Figure 7-5.
	19	External trip - B (N.C.) Normally closed contact input. When a digital input is set to “Ext trip-B” is OFF (Open), the drive displays the fault and turns off its output power. **Figure 7-5 External Trip** 
	20	Self-Diagnostic function Defines a digital input to initiate the self-diagnostic function capability of the drive unit. Parameter H60 = Self-Diagnostic function is used to define the test to conduct; IGBT fault and ground fault, Output phase short/open circuit/ ground fault or ground fault (IGBT fault/output phase short/open circuit). See Chapter 8 - Customizing Your Application for advanced drive function description.
	21	Change from PID to V/Hz Operation Selects a digital input to bypass the PID Feedback controller and selects the default V/Hz control settings. See Chapter 8 Customizing your application for advanced drive function.
	22	Exchange between second source and drive When the defined input is turned ON, setting values in P46 and P47 are used for control and reference to the drive. These settings cannot be changed while the digital input is closed.

Group	Number Selection	Description
Terminal (Cont.)	**t1-t8 (cont)**	**Digital Input 1-8 Define (cont.)**
	23	Analog Hold Locks the analog speed reference at the last value when the input was closed. Available when P40 = Frequency setting method is set in the range of 2-7. **Figure 7-6 Analog Hold** 
	24	Accel/Decel Disable Disables the acceleration or deceleration ramp while the digital input is closed, holding the reference at its last value. See Figure 7-6.
	25	Up/Down Frequency Save Initialization When the digital input is active, the last Up/Down frequency is saved. Usable when digital inputs are configured as 15 = Frequency Increase (UP) and 16 = Frequency Decrease (DOWN). See Figure 7-6.
	26	Jog Forward Defines a digital input for jog forward operation using F20 Jog Frequency.
	27	Jog Reserve Defines a digital input for jog reverse operation using F20 Jog Frequency.
	28	Timer Reset Resets the internal timer value to zero.
		Digital Input 1-8 Define
		See Also: N/A
	t9	**Filtering Time Constant for Digital input terminal** Access: Tune Default: 4 Range: 1 - 15
		The higher the value, the slower the responsiveness of the digital input becomes.
		See Also: t1-t8

Group	Number Selection	Description
Terminal (Cont.)	**t10**	**Preset Speeds 4-6** Default: 30 Access: Tune
	t11	Default: 25 Access: Tune
	t12	Default: 20 Access: Tune
	t13	Default: 15 Access: Tune
		Range: 0 - 400 Hz
		Provides a fixed Speed Command value when Digital Input 1 - 8 is set for a Preset Speed (Option 5, 6 and 7). Closing a digital input programmed as a preset speed will cause the drive to operate at the defined speed. Preset speeds 1-3 are set in the programming group (P43-P45) while preset speeds 4-7 are set in the terminal group (t10-t13). **Figure 7-7 Preset Speeds** See Also: t1-t8, t14-t27, P43-P45

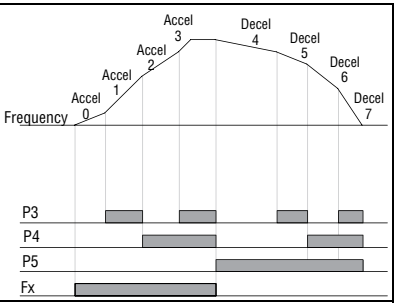
Param	Preset Speed	Speed Select		
		3	2	1
P40	Freq. Comm.	-	-	-
P43	1	-	-	✓
P44	2	-	✓	-
P45	3	-	✓	✓
t10	4	✓	-	-
t11	5	✓	-	✓
t12	6	✓	✓	-
t13	7	✓	✓	✓



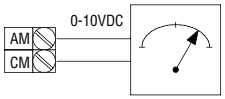
Group	Number Selection	Description
Terminal (Cont.)		**Preset Accel/Decel Time 1-7**
	t14	Default: 3.0 Access: Tune
	t15	Default: 3.0 Access: Tune
	t16	Default: 4.0 Access: Tune
	t17	Default: 4.0 Access: Tune
	t18	Default: 5.0 Access: Tune
	t19	Default: 5.0 Access: Tune
	t20	Default: 6.0 Access: Tune
	t21	Default: 6.0 Access: Tune
	t22	Default: 7.0 Access: Tune
	t23	Default: 7.0 Access: Tune
	t24	Default: 8.0 Access: Tune
	t25	Default: 8.0 Access: Tune
	t26	Default: 9.0 Access: Tune
	t27	Default: 9.0 Access: Tune
		Range: 0 - 6000 sec
		Sets multiple acceleration and deceleration ramps based on a digital input closure.

Figure 7-8 Preset Accel/Decel Time 1-7

Param	Preset Accel/ Decel	Ramp Select		
		3	2	1
P41, P42	0	-	-	-
t14, t15	1	-	-	⌐
t16, t17	2	-	⌐	-
t18, t19	3	-	⌐	⌐
t20, t21	4	⌐	-	-
t22, t23	5	⌐	-	⌐
t24, t25	6	⌐	⌐	-
t26, t27	7	⌐	⌐	⌐

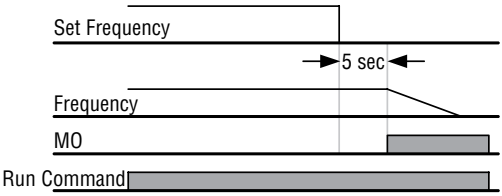


See Also: t1-t8, t10-t13, P43-P45

Group	Number Selection	Description
Terminal (Cont.)	**t28**	**Analog Output Select** Access: Tune Default: 0 Range: 0 - 3
		Selects the value to send to the analog output terminals. **Figure 7-9 Analog Output Select** Setting: / 10V Output Proportional to: 0 = Output Frequency — P36 - Frequency High Limit 1 = Output Current — 150% of Inverter rated current 2 = Output Voltage — 282VAC or 564VAC (200V or 400V Drive Rating) 3 = DC Link Voltage — 400VDC or 800VDC (200V or 400V Drive Rating) 
		Sets Also: t29
	t29	**Analog Output Level Adjustment** Access: Tune Default: 100 Range: 10 - 200%
		Adjusts the scaling of the analog output based on a 10V signal.
		See Also: t28
	t30	**Frequency Detection Level** Access: Tune Default: 30 Range: 0 - 400 Hz
		Used when t32 or t33 are set to 0-4, can not be set higher than P36 (Frequency High Limit).
		See Also: t32-t33, Chapter 8
	t31	**Frequency Detection Bandwidth** Access: Tune Default: 10 Range: 0 - 400 Hz
		Used when t32 or t33 are set to 0-4, can not be set higher than P36 (Frequency High Limit).
		See Also: t32-t33, Chapter 8

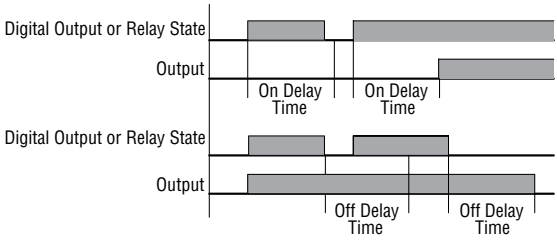
Group	Number Selection	Description
Terminal (Cont.)	**t32**	**Digital Output (MO)** Access: Tune Default: 12 Range: 0 - 18
	0	FDT-1
	1	FDT-2
	2	FDT-3
	3	FDT-4
	4	FDT-5
	5	Overload (OLt)
	6	Inverter Overload (IoIT)
	7	Motor Stall
	8	Over voltage trip (OV)
	9	Low voltage trip (LV)
	10	Inverter overheat (OH)
	11	Command Loss
	12	During run
	13	During stop
	14	During constant run
	15	During speed searching
	16	Wait time for run signal input
	17	Fault Output
	18	Cooling Fan Trip Alarm
	19	Brake Signal Select
	20	Timer Output
		Sets the on/off point for the Digital output.
		See Also: t34, F54-F55, F59-F60, Chapter 8

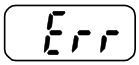
Group	Number Selection	Description
Terminal (Cont.)	**t33**	**Relay Output (3A - 3C)** Access: Tune Default: 17 Range: 0 - 18
	0	FDT-1
	1	FDT-2
	2	FDT-3
	3	FDT-4
	4	FDT-5
	5	Overload (OLt)
	6	Inverter Overload (LoIT)
	7	Motor Stall
	8	Over voltage trip (OV)
	9	Low voltage trip (LV)
	10	Inverter overheat (OH)
	11	Command Loss
	12	During run
	13	During stop
	14	During constant run
	15	During speed searching
	16	Wait time for run signal input
	17	Fault Output
	18	Cooling Fan Trip Alarm
	19	Brake Signal Select
	20	Timer Output
		Sets the on/off point for the Relay outputs.
		See Also: t34, F54-F55, F59-F60, Chapter 8

Group	Number Selection	Description
Terminal (Cont.)	**t34**	**Fault Relay Output** Access: Tune Default: 2 Range: 0 - 7
	0 1 2 3 4 5 6 **7**	[3] Bit 2 / [2] Bit 1 / [1] Bit 0 0: - - - 1: - - ✓ 2: - ✓ - 3: - ✓ ✓ 4: ✓ - - 5: ✓ - ✓ 6: ✓ ✓ - 7: ✓ ✓ ✓
		Outputs a fault code when t33 - Relay Output is set to 17: Fault Output. [1] When setting H26 (Auto restart attempts). [2] When trip other than low voltage trip occurs. [3] When low voltage trip occurs.
		See Also: t33, Chapter 8
	t35	**Criteria for Analog Input Signal Loss** Access: Tune Default: 0 Range: 0 - 2
	0	Disabled. (Does not check the analog input signal loss)
	1	Activated when less than half the value set in t36, t41, t46.
	2	Activated when less than the value set in t36, t41, t46) Selects the drive mode when frequency reference set by the Analog (V1, I) input terminal or communication option is lost.
		Outputs a fault code when t33 - Relay Output is set to 17: Fault Output. Example 1) The inverter determines the freq reference is lost when P40 - Freq set method is set to 3 (Analog V1 input), t16 to 1 and analog input signal is less than half the value set in t36. Example 2) The inverter determines the freq reference is lost when P40 - Freq set method is set to 6 (V1+I), t16 to 2 and V1 input signal is either less than the value set in t36 or I input value is less than the t46 value. Example diagram when t35 is set to 2, I62 to 2, I63 to 5.0 sec and t32 to 11: **Figure 7-10 Criteria for Analog Input Signal Loss** 
		See Also: N/A

Group	Number Selection	Description
Terminal (Cont.)	**t36**	**Analog Input 0 to -10V (NV) Min Voltage** Access: Tune Default: 0 Range: 0 to 10V
		Sets the minimum voltage of the NV (-10 to 0V) input.
		See Also: P40, t37
	t37	**Frequency corresponding to t36** Access: Tune Default: 0 Range: 0 - 400 Hz
		Sets the inverter output minimum frequency at minimum voltage of the NV input.
		See Also: t36
	t38	**Analog Input 0 to -10V (NV) Max Voltage** Access: Tune Default: 10 Range: 0 to 10V
		Sets the maximum voltage of the NV input.
		See Also: P40, t39
	t39	**Frequency corresponding to t38** Access: Tune Default: 60 Range: 0 - 400 Hz
		Sets the inverter output maximum frequency at maximum voltage of the NV input.
		See Also: t38
	t40	**Analog Input 0 - 10V (V1) Filter Time Constant** Access: Tune Default: 10 Range: 0 - 9999
		Adjusts the responsiveness of the Analog (V1) input (0 to 10V) to filter noise.
		See Also: P40, t41-t43
	t41	**Analog Input 0 - 10V (V1) Min Voltage** Access: Tune Default: 0 Range: 0 - 10V
		Sets the minimum voltage of the Analog Input (V1) input.
		See Also: t40, t42
	t42	**Frequency corresponding to t41** Access: Tune Default: 0 Range: 0 - 400 Hz
		Sets the inverter output minimum frequency at minimum voltage of the V1 input.
		See Also: t41
	t43	**Analog Input 0-10V (V1) Max Voltage** Access: Tune Default: 10 Range: 0 - 10V
		Sets the maximum voltage of the V1 input.
		See Also: t44

Group	Number Selection	Description
Terminal (Cont.)	**t44**	**Frequency corresponding to t43** Access: Tune Default: 60 Range: 0 - 400 Hz
		Sets the inverter output maximum frequency at maximum voltage of the V1 input.
		See Also: t43
	t45	**Analog Input 0-20mA (I) Filter Time Constant** Access: Tune Default: 10 Range: 1-9999
		Adjusts the responsiveness of the Analog (I) input (0-20mA) to filter noise.
		See Also: P40, t46-t49
	t46	**Analog Input 0-20mA (I) Min Current** Access: Tune Default: 4 Range: 0 - 20mA
		Sets the minimum current of the Analog 0-20mA (I) Input.
		See Also: t45, t47
	t47	**Frequency corresponding to t46** Access: Tune Default: 0 Range: 0 - 400 Hz
		Sets the inverter output minimum frequency at minimum current of the I input.
		See Also: t46
	t48	**Analog Input 0-20mA (I) Max Current** Access: Tune Default: 20 Range: 0 - 20mA
		Sets the maximum current of the Analog 0-20mA (I) Input.
		See Also: t47
	t49	**Frequency corresponding to t48** Access: Tune Default: 60 Range: 0 - 400 Hz
		Sets the inverter output maximum frequency at maximum current of the I input.
		See Also: t48
	t50	**Digital Output (MO) On Delay** Access: R/W Default: 0 Range: 0 to 3,600 Seconds
		Sets the on delay timer for the digital output.
		See Also: t32 and t33
	t51	**Relay Output (3A - 3C) On Delay** Access: R/W Default: 0 Range: 0 to 3,600 Seconds
		Sets the on delay timer for the relay output.
		See Also: t32 and t33

Group	Number Selection	Description
Terminal (Cont.)	**t52**	**Digital Output (M0) Off Delay** Access: R/W Default: 0 Range: 0 to 3,600 Seconds
		Sets the off delay timer for the digital output.
		See Also: t47
	t53	**Relay Output (3A - 3C) Off Delay** Access: R/W Default: 0 Range: 0 to 3,600 Seconds
		Sets the off delay timer for the relay output.
		See Also: t60-t61, t64-t81
	t50 - t53 (cont)	t50 and t51 On Delay and t52 and t53 Off Delay Timers Setting a value of greater than zero will begin the On, Off or both timers when the condition set in t32 and t33 for the digital outputs is met. In the case of the On delay timer, the actual output will not change state until the time value set in t50 to t51 is met. The Condition set in t32 to t33 must be active when the timer is reached for the output state to change. In the case of the Off delay timer, once the output state is on, it will delay turning off after the Off delay value is reached on t52 to t53. When the Off delay time is reached, the condition set in t32 to t33 must still be off. **Figure 7-11 Digital and Relay On/Off Delay** 
	t54	**Timer Value** Access: R/W Default: 5 Range: 0 to 3,600 Seconds
		Sets the desired run time for internal timer. Set the desired terminal from P1 to P8 to start the timer. When the timer reaches its programmed value set in t54, the state of either the M0 or Relay Output will change when either is set to a value of 20. Closing any digital input programmed as 28 will reset the timer back to a zero value.
		See Also: t1-t8, t32, t33

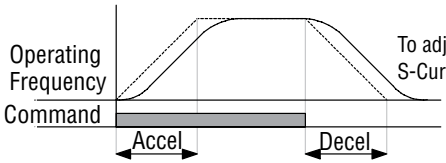
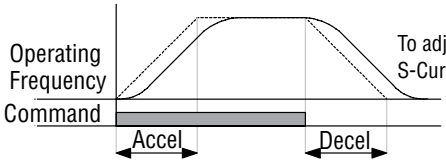
Group	Number Selection	Description
Terminal (Cont.)	**t57**	**Keypad Error Output** Access: Tune Default: 0 Range: 0 - 3
	0	Not used
	1	Signal output to MO
	2	Signal output to 3A, 3B contacts
	3	Signal output to MO, 3A, 3B
		Selects the Digital and/or Relay output when a keypad-inverter communication fails. Relay Output Bit 2 | Digital Output Bit 0 0 - - 1 - ✓ 2 ✓ - 3 ✓ ✓ When communication error occurs for a certain time, will be displayed and the error signal can be sent to the Digital (MO) or Relay output. 
		See Also: N/A
	t59	**Communication protocol select** Access: R/W Default: 0 Range: 0 - 1
	0	Modbus RTU
	1	CI485
		Sets the protocol for the serial communication network.
		See Also: t60, t61, t64-t81
	t60	**Inverter Number** Access: Tune Default: 1 Range: 1 - 250
		Sets the protocol for the serial communication network.
		See Also: t60, t61, t64-t81
	t61	**Baud Rate** Access: Tune Default: 3 Range: 0 - 4
	0	1200 [bps]
	1	2400 [bps]
	2	4800 [bps]
	3	9600 [bps]
	4	19200 [bps]
		Selects the Baud Rate of RS485 Communication.
		See Also: t59-t60, t64-t81

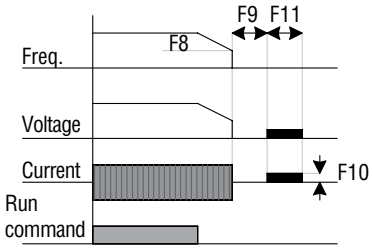
Group	Number Selection	Description
Terminal (Cont.)	**t62**	**Frequency Loss Mode** Access: Tune Default: 0 Range: 0 - 2
	0	Continue operation at last Speed Command
	1	Coast to Stop
	2	Decelerate to stop
		When the frequency reference is from the Analog Input or RS485 Port, this parameters sets the action to take if the speed reference is lost.
		See Also: P40, t35, t63
	t63	**Frequency Loss Wait Time** Access: Tune Default: 1.0 Range: 0.1-120 Sec
		This is the time delay before the drive takes action in the event of a command frequency loss. If there is no Speed Command input during the time set in this parameter, the drive starts to operate in the mode selected in t62.
		See Also: P40, t35, t62
	t64	**Communication Time Setting** Access: Tune Default: 5 Range: 2 - 100 ms
		Frame Communication time.
		See Also: t59-t61, t65-t81
	t65	**Parity/Stop Bit Setting** Access: Tune Default: 0 Range: 0 - 3
	0	Parity: None, Stop Bit: 1
	1	Parity: None, Stop Bit: 2
	2	Parity: Even, Stop Bit: 1
	3	Parity: Odd, Stop Bit: 1
		When the protocol is set, the communication format can be set.
		See Also: t59-t61, t64, t66-t81
	t66	**Read address register 1 - 8** Default: 0005 Access: Tune
	t67	Default: 0006 Access: Tune
	t68	Default: 0007 Access: Tune
	t69	Default: 0008 Access: Tune
	t70	Default: 0009 Access: Tune
	t71	Default: 000A Access: Tune
	t72	Default: 000B Access: Tune
	t73	Default: 000C Access: Tune
		Range: 0-42239
		Allows up to 8 discontinuous addresses to be read with one read command.
		See Also: N/A

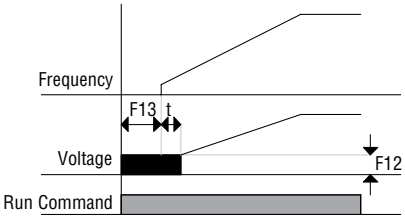
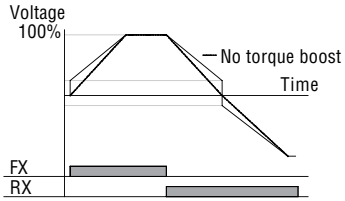
Group	Number Selection	Description
Terminal (Cont.)	t74	**Write address register 1 - 8** Default: 0005 Access: Tune
	t75	Default: 0006 Access: Tune
	t76	Default: 0007 Access: Tune
	t77	Default: 0008 Access: Tune
	t78	Default: 0005 Access: Tune
	t79	Default: 0006 Access: Tune
	t80	Default: 0007 Access: Tune
	t81	Default: 0008 Access: Tune
		Range: 0-42239
		Allows up to 8 discontinuous addresses to be written with one write command.
		See Also: N/A
	t82	**Brake Open Current** Access: Tune Default: 50.0 Range: 0 - 180 Amps
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t87
	t83	**Brake Open Delay Time** Access: R/W Default: 1.00 Seconds Range: 0 - 10 Seconds
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t8
	t84	**Brake Open FX Frequency** Access: R/W Default: 1.00 Hz Range: 0 - 400 Hz
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t8
	t85	**Brake Open RX Frequency** Access: R/W Default: 1.00 Hz Range: 0 - 400 Hz
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t8

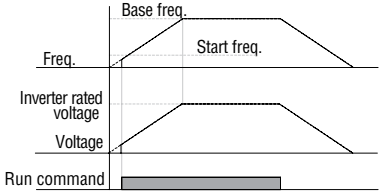
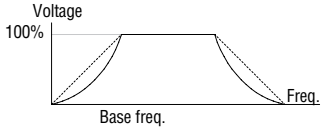
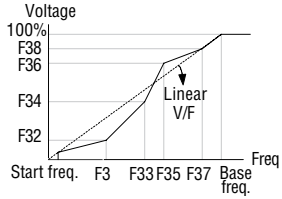
Group	Number Selection	Description
Terminal (Cont.)	**t86**	**Brake Close Delay Time** Access: R/W Default: 1.00 Seconds Range: 0 - 10 Seconds
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t8
	t87	**Brake Close Frequency** Access: R/W Default: 2.00 Hz Range: 0 - 400 Hz
		Parameters t82 through t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to zero (V/F Control).
		See Also: t32, t33, H40, t82 - t8

7.5 Function 1 Group

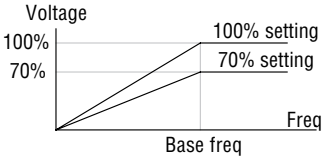
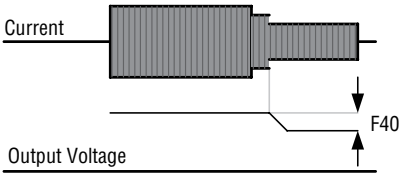
Group	Number Selection	Description
Function 1	**F0**	**Jump Code** Access: Tune Default: 1 Range: 0 - 99
		Sets the parameter number to jump directly to. Jump must be within the group.
		See Also: N/A
	F1	**Forward/Reverse Disable** Access: R/W Default: 0 Range: 0 - 2
	0	Forward and Reverse run enable
	1	Forward run disable
	2	Reverse run disable
		Enables/disables the function that allows the direction of the motor rotation to be changed. The forward or reverse command may come from a digital command, the keypad or serial command. All forward or reverse inputs will be ignored if the corresponding directional control is disabled in F1.
		See Also: N/A
	F2	**Accel Pattern** Access: R/W Default: 0 Range: 0, 1
	0	Linear
	1	S-Curve
		Sets the acceleration pattern.  To adjust the slope of the S-Curve see H17 and H18.
		See Also: H17, H18, t1-t8
	F3	**Decel Pattern** Access: R/W Default: 0 Range: 0, 1
	0	Linear
	1	S-Curve
		Sets the deceleration pattern.  To adjust the slope of the S-Curve see H17 and H18.
		See Also: H17, H18, t1-t8

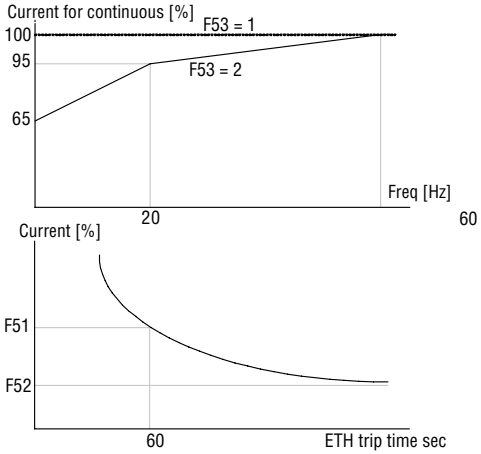
Group	Number Selection	Description
Function 1 (Cont.)	**F8**	**DC Brake Start Frequency** Access: R/W Default: 5.00 Range: 0.1 - 60 Hz
		Sets the DC brake start frequency, it can not be set to less than P35 - Frequency low limit. Setting this value too high may cause an over current trip. Trips can be prevented by adjusting F9 - DC Brake wait time. 
		See Also: H17, H18, t1-t8
	F9	**DC Brake Wait Time** Access: R/W Default: 0.1 Range: 0 - 60 Sec
		The drive will hold for the time set in F9 after F8 - DC Brake start frequency is reached before it applies the voltage level set in F10 - DC Brake Voltage. Use DC Brake wait time when the load inertia is large to prevent nuisance trips or damage to the motor. Note: Only viewable when P39 - Stop mode select is set to DC Brake.
		See Also: P35, P39, F8-F11
	F10	**DC Brake Voltage** Access: R/W Default: 50 Range: 0 - 200%
		Sets the DC Brake Voltage as a percent of P32 - Motor Rated Current. Note: Only viewable when P39 - Stop mode select is set to DC Brake.
		See Also: P32,P35, P39, F8-F11
	F11	**DC Brake Time** Access: R/W Default: 1.0 Range: 0 - 60 Sec
		Sets the time for F10 - DC Brake Voltage to be applied to the motor after F9 - DC Brake wait time. Setting F10 or F11 to zero will disable the DC Brake function. In case of DC Brake at high load inertia and frequency, change the DC brake controller gain according to H37 set value. Note: Only viewable when P39 - Stop mode select is set to DC Brake.
		See Also: N/A
	F12	**DC Brake Start Voltage** Access: R/W Default: 50 Range: 0 - 200%
		Sets the amount of DC voltage before a motor starts to run. It is set as percentage of P33 - Motor rated current.
		See Also: F12, t1-t8

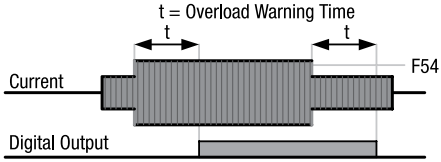
Group	Number Selection	Description
Function 1 (Cont.)	**F13**	**DC Brake Start Time** Access: R/W Default: 0 Range: 0 - 60 Sec
		DC voltage is applied to the motor for DC Brake start time before motor accelerates. 
		See Also: F12, t1-t8
	F14	**Time for Magnetizing a Motor** Access: R/W Default: 0.1 Range: 0 - 60 Sec
		This parameter accelerates the motor after pre-exciting the motor for the set time. The amount of the pre-exciting current is set in H34 - Motor no load current.
		See Also: P30, P32, H32, H34, H40, H42, H44
	F20	**Jog Frequency** Access: Tune Default: 10.00 Range: 0 - 400 Hz
		Sets the Jog Frequency, cannot be set greater than P36 - Frequency High Limit. Jog is only available in 2Wire control mode.
		See Also: P36, t1-t8
	F27	**Torque Boost Select** Access: R/W Default: 0 Range: 0, 1
	0	Manual Torque Boost
	1	Auto Torque Boost
		If F27 = 0, set manual torque boost values in F28 and F29. If F27 = 1 (Auto torque boost), the inverter automatically calculates torque boost values using motor parameters and outputs the corresponding voltage. Before enabling Auto torque boost, H34 - No load current and H42- Stator resistance must be set properly. 
		See Also: F28, F29, H34, H41, H42

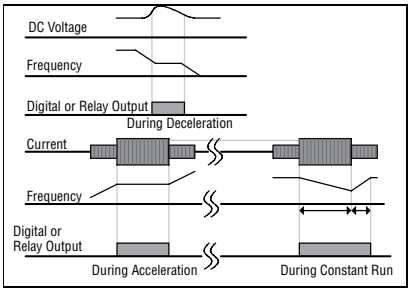
Group	Number Selection	Description
Function 1 (Cont.)	**F28**	**Torque Boost in Forward Direction** Access: R/W Default: 2 Range: 0 - 15%
		This parameter sets the amount of torque boost applied to a motor during forward run. It is set as a percent of maximum output voltage.
		See Also: F27-F29
	F29	**Torque Boost in Reverse Direction** Access: R/W Default: 2 Range: 0 - 15%
		This parameter sets the amount of torque boost applied to a motor during reverse run. It is set as a percent of maximum output voltage.
		See Also: F27-F29
	F30	**V/F Pattern** Access: R/W Default: 0 Range: 0 - 2
	0	Linear
	1	Square
	2	User V/F
		Selects a pattern for the drive. 0 = Linear volts per hertz ratio from P35 - Frequency low limit to P34 -Base frequency.  1 = Squared volts per hertz ratio. Applications are fans, pumps or variable torque.  2 = User V/F is a custom volts per hertz pattern established using parameters F31-F38. 
		See Also: P34, P35, F31-F38, H40

Group	Number Selection	Description
Function 1 (Cont.)	**F31**	**User V/F Frequency 1** Access: R/W Default: 15 Range: 0 - 400 Hz
		When F30 = 2, selects the frequency for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F32	**User V/F Voltage 1** Access: R/W Default: 25 Range: 0 - 100%
		When F30 = 2, selects the voltage for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F33	**User V/F Frequency 2** Access: R/W Default: 30 Range: 0 - 400 Hz
		When F30 = 2, selects the frequency for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F34	**User V/F Voltage 2** Access: R/W Default: 50 Range: 0 - 100%
		When F30 = 2, selects the voltage for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F35	**User V/F Frequency 3** Access: R/W Default: 45 Range: 0 - 400 Hz
		When F30 = 2, selects the frequency for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F36	**User V/F Voltage 3** Access: R/W Default: 75 Range: 0 - 100%
		When F30 = 2, selects the voltage for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F37	**User V/F Frequency 4** Access: R/W Default: 60 Range: 0 - 400 Hz
		When F30 = 2, selects the frequency for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40

Group	Number Selection	Description
Function 1 (Cont.)	**F38**	**User V/F Voltage 4** Access: R/W Default: 100 Range: 0 - 100%
		When F30 = 2, selects the voltage for each point in a custom volts per hertz pattern.
		See Also: P34, P35, F31-F38, H40
	F39	**Output Voltage Adjustment** Access: R/W Default: 100 Range: 40 - 110%
		This parameter adjusts the amount of output voltage, set as a percentage of input voltage. Use when the motor voltage is less than the input voltage. 
		See Also: N/A
	F40	**Energy Savings Level** Access: Tune Default: 0 Range: 0 - 30%
		Adjusts the output voltage according to load status. It is set as a percent of the maximum output voltage. When used on pump and fan applications, it can dramatically reduce energy consumption by decreasing the output voltage with light loads. 
		See Also: N/A
	F50	**Electronic Thermal Select** Access: Tune Default: 0 Range: 0 - 1
		Setting this parameter to a 1 enables the electronic thermal overload. It activates when the motor is overheated if current is greater than the value set in F51 (time-inverse), and the drive output is turned off for the preset time. Note: Only viewable when F50 = 1 (Electronic Thermal Overload).
		See Also: F51, F52, F53

Group	Number Selection	Description
Function 1 (Cont.)	**F51**	**Electronic Thermal Level for 1 Minute** Access: Tune Default: 150 Range: F52 - 200%
		Sets the maximum current capable of flowing to the motor continuously for 1 minute. The set value is a percentage of P32 - Motor Rated Current. It cannot be set lower than F52 - Electronic thermal level for continuous.
		See Also: F50, F52, F53
	F52	**Electronic Thermal Level for Continuous** Access: Tune Default: 100% Range: 50 - F51%
		This parameter sets the amount of current to keep the motor running continuously. It cannot be set to exceed F51 - Electronic thermal level for 1 minute.
		See Also: F50, F52, F53
	F53	**Motor Cooling Method** Access: Tune Default: 0 Range: 0 - 1
	0	Standard Motor
	1	Variable Speed Motor) For a Standard Motor, cooling effects decrease when a motor is run at low speed. A Variable Speed motor is a special motor that uses a separately powered cooling fan to maximize cooling effect even at low speed.
		This parameter adjusts the amount of output voltage, set as a percentage of input voltage. Use when the motor voltage is less than the input voltage. 
		See Also: N/A

Group	Number Selection	Description
Function 1 (Cont.)	**F54**	**Overload Warning Level** Access: Tune Default: 150 Range: 30 - 150%
		Sets the amount of current to issue an alarm signal at a relay or digital output terminal (see parameters t32 and t33). The value is set as a percentage of P32 - Motor Rated Current. Select an output terminal for this function between M0 (Digital Output) and 3A-C (Relay Output). If selecting M0 as the output terminal, set t32 = 5 (Overload: OL).
		See Also: P32, t32, t33, F55
	F55	**Overload Warning Time** Access: Tune Default: 10 Range: 0 - 30 Sec
		This parameter issues an alarm signal when the current greater than F54 -Overload warning level flows to the motor for F55 - Overload warning time. 
		See Also: P32, t32, t33, F54
	F56	**Overload Trip Enable** Access: Tune Default: 1 Range: 0 - 1
	0	Overload trip is disabled.
	1	Overload trip is enabled.
		When set to a 1 = enabled, this parameter turns off the inverter output when the motor is overloaded. Overload level and time are set in F57 and F58 respectively.
		See Also: F57, F58
	F57	**Overload Trip Level** Access: Tune Default: 180 Range: 30 - 200%
		Sets the amount of overload current before the drive trips. The value is a percentage of P32 - Motor rated current.
		See Also: N/A
	F58	**Overload Trip Time** Access: Tune Default: 60 Range: 0 - 60 Sec
		The inverter output is turned off if the current level set in F57 is exceeded for the time set in F58 - Overload trip time.
		See Also: F56, F57

Group	Number Selection	Description
Function 1 (Cont.)	**F59**	**Stall Prevention Select** Access: R/W Default: 0 Range: 0 - 7
	0 1 2 3 4 5 6 7	<table><tr><th></th><th>During Decel Bit 2</th><th>During Run Bit 1</th><th>During Accel Bit 0</th></tr><tr><td>0</td><td>-</td><td>-</td><td>-</td></tr><tr><td>1</td><td>-</td><td>-</td><td>↗</td></tr><tr><td>2</td><td>-</td><td>↗</td><td>-</td></tr><tr><td>3</td><td>-</td><td>↗</td><td>↗</td></tr><tr><td>4</td><td>↗</td><td>-</td><td>-</td></tr><tr><td>5</td><td>↗</td><td>-</td><td>↗</td></tr><tr><td>6</td><td>↗</td><td>↗</td><td>-</td></tr><tr><td>7</td><td>↗</td><td>↗</td><td>↗</td></tr></table>
		Example: F59 = 3; stall prevention active during acceleration and constant run. When stall prevention is executed during acceleration or deceleration, accel/decel times may take longer than the user-setting time to prevent a stall condition. When stall prevention is activated during constant run, t1, t2 executed in accordance with the value set in P41 - Accel Time and P42 - Decel Time. 
		See Also: t32, t33, F60, F61
	During:	Function Description:
	Acceleration	Deceleration starts when current exceeds the value set in F60.
	Constant run	Deceleration starts when current exceeds the value set in F6.
	Deceleration	Deceleration stops when inverter DC link voltage rises above a certain voltage level.
	t32 and t33:	The drive output is active (either the MO or relay output (3A-C) terminals when set = 7 Motor Stall. Motor stall status can be monitored even if F59 is not active.
	F60	**Stall Prevention Level** Access: R/W Default: 150 Range: 30 - 200%
		This parameter sets the amount of current to activate stall prevention during acceleration, constant run or deceleration. The value set is a percentage of P32 - Motor Rated Current.
		See Also: P32, F59, F61

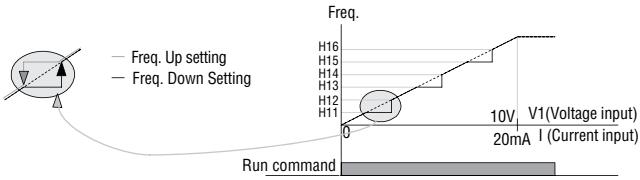
Group	Number Selection	Description
Function 1 (Cont.)	**F61**	**Stall Prevention** Access: R/W Default: 0 Range: 0 - 1
	0	Stall Prevention is disabled.
	1	Stall Prevention is enabled.
		Enable stall prevention during deceleration.
		See Also: F59, F60
	F63	**Save Up/Down Frequency** Access: R/W Default: 0 Range: 0 - 1
	0	Do not save Up/Down frequency
	1	Save Up/Down frequency
		This parameter decides whether to save the specified frequency during up/down operation. When 1 is selected, the up/down frequency is saved in F64.
		See Also: P40, t1 - t8, F64 - F66
	F64	**Saved Up/Down Frequency** Access: Tune Default: 0.00 Range: 0 - 400 Hz
		Stores the up/down frequency if F63 = 1 before the drive stops or decelerates. Notes: F64 viewable when F63 = 1 (Save up/down frequency)
		See Also: P40, t1 - t8, F63, F65, F66
	F65	**MOP Mode Select** Access: R/W Default: 0 Range: 0 - 2
	0	Reference frequency changed between ranges of P35 and P36.
	1	Increase or decrease speed after an edge input frequency increments set in F66.
	2	Combination of 0 and 1.
		Mode selects the MOP ramp function.
		See Also: P35, P36, P40, t1 - t8, F63, F64, F66
	F66	**MOP Step Frequency** Access: R/W Default: 0.00 Hz Range: 0 - 400 Hz
		MOP Up-Down frequency sets the step value change for the MOP function.
		See Also: P40, t1 - t8, F63 - F65
	F67	**Start Frequency** Access: R/W Default: 0.5 Range: 0.10 - 10.00 Hz
		The drive starts to output its voltage at this frequency. It is the low frequency limit.
		See Also: N/A

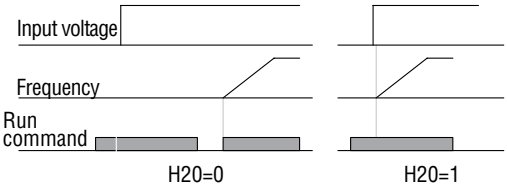
Group	Number Selection	Description
Function 1 (Cont.)	**F70**	**Draw Control** Access: R/W Default: 0 Range: 0 - 3
	0	Draw mode not enabled
	1	V1 (0-10V) input draw operation
	2	I (0-20mA) input draw operation
	3	V1 (-10-10V) input draw operation
		Enables Draw control and selects the reference input.
		See Also: N/A
	F71	**Draw Ratio** Access: Tune Default: 0.0% Range: 0 - 100%
		Sets the percent value draw control affects the speed reference.
		See Also: N/A
	F72	**Sleep Mode Boost Enable** Access: R/W Default: 0 Range: 0 - 1
	0	Boost Disable
	1	Boost Enable
		Enables Boost Time and Boost Frequency when drive goes into Sleep Mode.
		See Also: H49, F73, F74
	F73	**Sleep Mode Boost Time** Access: R/W Default: 10.00 Range: 0.0 - 120.0 sec
		Sets a Boost Duration Time when the drive goes into Sleep Mode.
		See Also: H49, F72, F74
	F74	**Sleep Mode Boost Frequency** Access: Tune Default: 30.00 Range: 0 - Max. Frequency (Hz)
		Sets a Boost Frequency when the drive goes into Sleep Mode.
		See Also: H49, H-62, F72, F73, P36

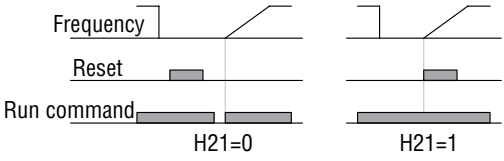
7.6 Function 2 Group

Group	Number Selection	Description
Function 2	**H0**	**Jump Code** Access: Tune Default: 1 Range: 0 - 99
		Sets the parameter number to jump directly to. Jump must be within the group.
		See Also: N/A
	H1 - H5	**Last Fault 1 - 5** Access: RO Default: nOn Range: N/A
		Stores information on the types of faults, the frequency, the current and the Accel/Decel condition at the time of fault. The latest fault is automatically stored in the H1 - Fault History 1. Up to the last five faults can be stored. When a fault occurs during operation, it can be monitored in the d - display parameters under nOn.
		See Also: H6, Chapter 9
		See Also: H17, H18, t1-t8
	H6	**Reset Fault History** Access: Tune Default: 0 Range: 0 - 1
	0	—
	1	Clear Fault History in H1 to H5
		Clears the fault history saved in H1 to H5.
		See Also: H1-H5
	H7	**Dwell Frequency** Access: R/W Default: 5.00 Range: 0.1 - 400 Hz
		When run command is issued, the motor will accelerate after the Dwell Frequency is applied for the Dwell Time - H8. Dwell frequency can be set within Frequency High and Low Limits (P35 and P36). Dwell frequency is used to output torque in an intended direction. It is useful in hoisting applications to apply torque before releasing a mechanical brake. Rated slip frequency is calculated by the following formula: $f_s = f_r\left(\frac{RPM \times P}{120}\right)$ f_s = Rated slip frequency f_r = Rated frequency P = Number of motor poles
		See Also: P35, P36, H8

Group	Number Selection	Description
Function 2 (Cont.)	**H8**	**Dwell Time** Access: R/W Default: 0.0 Range: 0 - 10 Sec
		Sets the time for dwell operation.
		See Also: H7, H11-H16
	H10	**Skip Frequency Enable** Access: R/W Default: 0 Range: 0 - 1
	0	Disable Skip Frequency
	1	Enable Skip Frequency
		Set this parameter = 1 to enable the skip frequency settings configured in H11 thru H16. When it is desirable to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be skipped. Three different areas of Skip frequency High/Low limit can be set. During acceleration or deceleration however, the run frequency within the set area is valid.
		See Also: H11 - H16
	H11	**Skip Frequency Low Limit 1 - 3** Default: 10 Access: R/W Range: 0 - H12 Hz
	H13	Default: 20 Access: R/W Range: 0 - H14 Hz
	H15	Default: 30 Access: R/W Range: 0 - H16 Hz
		Range: 0 - 400 Hz
		Run frequency cannot be set within the range of H11 thru H16. The frequency values of the low numbered parameters cannot be set above those of the high numbered ones. Settable within the range of Frequency High and Low Limits (P35 and P36). Sets the lower limit of frequency range 1 to skip.
		See Also: H10, Figure 7-12
	H12	**Skip Frequency High Limit 1 - 3** Default: 15 Access: R/W Range: H11 - 400 Hz
	H14	Default: 25 Access: R/W Range: H13 - 400 Hz
	H16	Default: 35 Access: R/W Range: H15 - 400 Hz
		Range: 0 - 400 Hz
		Run frequency cannot be set within the range of H11 thru H16. The frequency values of the low numbered parameters cannot be set above those of the high numbered ones. Settable within the range of Frequency High and Low Limits (P35 and P36). Sets the lower limit of frequency range 1 to skip.
		See Also: H10, Figure 7-12

Group	Number Selection	Description
Function 2 (Cont.)	**H11 - H16 (cont)**	Case 1: If frequency set value (Analog setting by voltage, current, RS485 or keypad) is within the range of skip frequency, it maintains the low limit value. If the set value is outside the range, it increases the frequency up to the set value. Case 2: In the case of a decreasing frequency setting, if the frequency set value (Analog setting by voltage, current, RS485 or keypad) is within the range of skip frequency, it maintains skip frequency high value. If the setting is outside the range, it decreases frequency to the set value. **Figure 7-12** 
	H17	**S-Curve Accel/Decel Start Side** Access: R/W Default: 40 Range: 1 - 100%
		See Figure 7-13.
		See Also: N/A
	H18	**S-Curve Accel/Decel End Side** Access: R/W Default: 40 Range: 1 - 100%
		See Figure 7-13.
		See Also: N/A
	H17 - H18 (cont)	Set the speed reference value to form a curve at the start and end cycle of the acceleration and deceleration curves. If it is set higher, linear zone gets smaller. H17 sets the starting and H18 the ending ratio between S-Curve and Linear in 1/2 of Accel/Decel Ref. Frequency. For smooth Accel/Decel starting, increase H17 or H18 to extend the S-Curve ratio. Note: Setting Frequency Ref. for Accel/Decel (H70) is set to Max Freq and target freq is set below Max freq. the shape of the S-Curve may be distorted. **Figure 7-13** $\text{Accel time for S-curve setting} = P41 + P41 \times \frac{H17}{2} + P41 \times \frac{H18}{2}$ $\text{Decel time for S-curve setting} = P42 + P42 \times \frac{H17}{2} + P42 \times \frac{H18}{2}$

Group	Number Selection	Description
Function 2 (Cont.)	**H19**	**Phase Loss Protection** Access: Tune Default: 0 Range: 0 - 3
	0	Not Used
	1	Output phase loss protection
	2	Input phase loss protection
	3	Input/output phase loss protection
		Setting H19 to a value other than 0 enables Phase Loss Protection. Output Phase Loss: Inverter output is shut off in the event of more than one phase loss among U, V and W. Input Phase Loss: Inverter output is blocked at the event of more than one phase loss among R, S and T. If there is no input phase loss, output is shut off when it is time to replace the DC link capacitor. Note: Set P32 - Motor Rated Current correctly. If the actual motor rated current and the value of P32 are different, output phase loss protection function may not activate correctly.
		See Also: N/A
	H20	**Power On Start** Access: Tune Default: 0 Range: 0 - 1
	0	Disables power on start
	1	Enables power on start
		This parameter is activated when P38 - Drive Mode is set to 1 or 2 (Run/Stop from Control Terminal). Motor will accelerate after AC power is applied and a Forward Run (FX) or Reverse Run (RX) terminal is ON. 
		See Also: P38

Group	Number Selection	Description
Function 2 (Cont.)	**H21**	**Auto Restart** Access: Tune Default: 0 Range: 0 - 1
	0	Disables power on start
	1	Enables power on start
		This parameter is activated when P38 - Drive Mode is set to 1 or 2 (Run/Stop by the Control Terminal). Motor will accelerate after a fault condition is reset. A Forward Run (FX) or Reverse Run (RX) terminal must be ON to Auto Restart. 
		See Also: P38, H26, H27
	H22	**Speed Search Select** Access: R/W Default: 0 Range: 0-15
	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	

	[4] Bit 3	[3] Bit 2	[2] Bit 1	[1] Bit 0
0	-	-	-	-
1	-	-	-	✓
2	-	-	✓	-
3	-	-	✓	✓
4	-	✓	-	-
5	-	✓	-	✓
6	-	✓	✓	-
7	-	✓	✓	✓
8	✓	-	-	-
9	✓	-	-	✓
10	✓	-	✓	-
11	✓	-	✓	✓
12	✓	✓	-	-
13	✓	✓	-	✓
14	✓	✓	✓	-
15	✓	✓	✓	✓

This parameter is active to prevent any possible fault when the inverter outputs its voltage to the running motor.
[4] Speed search during H20 (power on start)
[3] Speed search during instant power failure restart
[2] Speed search during H21 (restart after fault reset)
[1] Speed search during acceleration

See Also: t32, t33, H23-H27, Chapter 8

Group	Number Selection	Description
Function 2 (Cont.)	**H23**	**Speed Search Current Level** Access: Tune Default: 100 Range: 80 - 200%
		This parameter limits the amount of current during speed search. The value is a percentage of P32 - Motor Rated Current.
		See Also: P32, H22, H24-H27, Chapter 8
	H24	**Speed Search P Gain** Access: Tune Default: 100 Range: 0 - 9999
		Sets the Proportional gain used for Speed Search PI Controller.
		See Also: Chapter 8
	H25	**Speed Search I Gain** Access: Tune Default: 200 Range: 0 - 9999
		Sets the Integral gain used for Speed Search PI Controller.
		See Also: Chapter 8
	H26	**Auto Restart Attempts** Access: Tune Default: 0 Range: 0 - 10 Attempts
		Sets the number of restart tries after a fault occurs. Auto restart becomes active after the time is reached in H27 - Auto Restart Time. Auto Restart is deactivated if the number of faults exceeds the value in H26 - Auto Restart Attempts. H26 is reset to its programmed value if STOP key or a control terminal reset is activated. If no trip occurs for 30 seconds after the auto restart operation, H26 is reset. It is not possible to restart (auto restart becomes deactivated) if the drive faults due to a Low Voltage (Lvt), Inverter Overheat (Oht) or a Hardware Trip (HWt) fault. This parameter sets the number of restart tries after a fault occurs. Auto restart becomes active after the time is reached in H27 - Auto Restart Time. Auto Restart is deactivated if the number of faults exceeds the value in H26 - Auto Restart Attempts.
		See Also: N/A
	H27	**Auto Restart Time** Access: Tune Default: 1.0 Range: 0 - 60 Sec
		Sets the time between auto restart attempts. After the Auto Restart Time, the motor starts acceleration automatically.
		See Also: P32, H22, H24-H27, Chapter 8

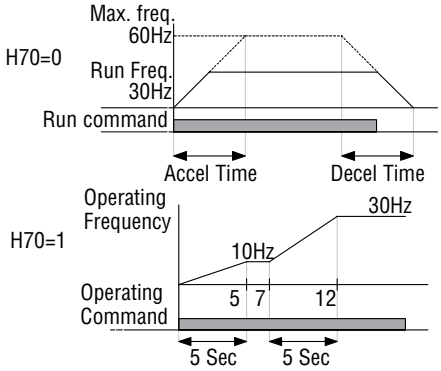
Group	Number Selection	Description
Function 2 (Cont.)	**H32**	**Slip Frequency** Access: R/W Default: 1.67 Range: 0 - 10 Hz
		Sets the motor slip frequency. This is a calculated value based on the following formula: Where: f_s = Rated Slip Frequency f_r = Rated Frequency RPM = Motor nameplate RPM P= Number of Motor Poles Example: f_r = 60Hz, RPM = 1740, Poles = 4 $f_s = f_r - \left(\frac{RPM \times P}{120}\right) = 60 - \left(\frac{1740 \times 4}{120}\right) = 2Hz$
		See Also: N/A
	H34	**No Load Motor Current** Access: R/W Default: Based on drive rating Range: 0.1 - 20 A
		The current value detected when the motor is rotating at rated speed (remove any load connected to the motor shaft). For applications where it is difficult to measure the no load current, enter a value of 50% of the rated nameplate motor current in this parameter.
		See Also: N/A
	H36	**Motor Efficiency** Access: R/W Default: 87 Range: 50 - 100%
		Sets the motor efficiency from the motor nameplate data.
		See Also: N/A
	H37	**Load Inertia Rate** Access: R/W Default: 0 Range: 0 - 2
	0	Load inertia rate is less than 10 times that of motor inertia
	1	Load inertia rate equal to approximately 10 times the motor inertia
	2	Load inertia rate is more than 10 times that of motor inertia
		Select range according to the connected inertia in relationship to the motor inertia.
		See Also: F8-F11, H40
	H39	**Carrier Frequency Select** Access: Tune Default: 2 Range: 2 - 15 kHz
		This parameter affects the audible sound of the motor, noise emission from the inverter, inverter temperature, and leakage current. If the set value is higher, the inverter sound is more quiet, but the noise from the inverter and leakage current will be increased.
		See Also: N/A

Group	Number Selection	Description
Function 2 (Cont.)	**H40**	**Control Mode Select** Access: R/W Default: 0 Range: 0 - 2
	0	Volts/Frequency Control
	1	Slip Compensation Control
	2	Not Active - Do Not Use
	3	Sensorless Vector Control
		Selects the control mode for the operation of the drive. See the following description of control method and the corresponding parameters for adjustment to each.
		See Also: N/A
	Volts/ Frequency	Basic Operation of the Drive, set standard motor parameters: P30 - Motor Hp P32 - Motor Rated Current P33 - Motor Poles F30 - V/F Pattern
	Slip Compensation	Allows the motor to run at constant speed by compensating inherent induction motor slip. Set parameters: P30 - Motor Hp P32 - Motor Rated Current P33 - Motor Poles H32 - Rated Slip Freq H34 - Motor No Load Current H36 - Motor Efficiency H37 - Load Inertia
	Sensorless Vector	Open Loop Speed Regulated drive control. Set parameters: P30 - Motor Hp P32 - Motor Rated Current H32 - Rated Slip Freq H34 - Motor No Load Current H41 - Auto tuning H42 - Stator resistance H44 - Leakage inductance F14 - Time for magnetizing
	H41	**Auto-Tuning** Access: R/W Default: 0 Range: 0 - 1
	0	—
	1	Start Auto-Tuning
		If this parameter is set to a 1, it automatically measures the values to assign for parameters H42 - Stator Resistance and H44 - Leakage inductance.
		See Also: H40, H42, H44
	H42	**Stator Resistance (Rs)** Access: R/W Default: Based on drive rating Range: 0 - 28 Ohms
		Sets the value of the motor stator resistance.
		See Also: H40, H41, H44

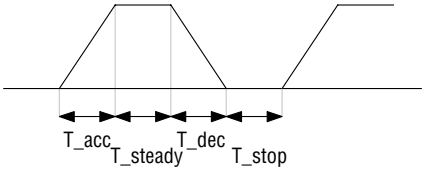
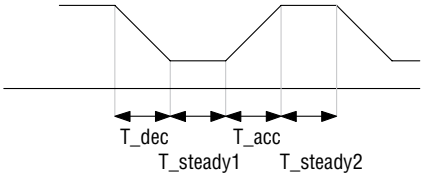
Group	Number Selection	Description
Function 2 (Cont.)	**H44**	**Leakage Inductance (Lσ)** Access: R/W Default: Based on drive rating Range: 0 - 300.0 mH
		This is the leakage inductance of the stator and rotor of the motor.
		See Also: H40, H41, H44
	H45	**Sensorless P Gain** Access: Tune Default: 1000 Range: 0 - 32767
		Proportional gain for Sensorless Vector Control. Set H40 = 3 (Sensorless Vector Control) to display these parameters.
		See Also: N/A
	H46	**Sensorless I Gain** Access: Tune Default: 100 Range: 0 - 32767
		Integral gain for Sensorless Vector Control. Set H40 = 3 (Sensorless Vector Control) to display these parameters.
		See Also: N/A
	H47	**Sensorless Torque Limit** Access: R/W Default: 180.0% Range: 100 - 200%
		Set torque limit in sensorless vector mode.
		See Also: N/A
	H48	**PWM Mode Select** Access: R/W Default: 0 Range: 0 - 1
	0	Normal PWM
	1	Single Phase PWM
		Enables PWM control for single phase operation.
		See Also: N/A
	H49	**PID Control Select** Access: R/W Default: 0 Range: 0 - 1
	0	No
	1	Yes
		Enable PID control.
		See Also: H50 - H58, H61 - H63, P48, d10, t1 - t8 (see chapter 8 for advanced PID features)
	H50	**PID Feedback Selection** Access: R/W Default: 0 Range: 0 - 1
	0	Terminal I Input (0-20 mA)
	1	Terminal V1 Input (0-10V))
		Selects the source for the PID loop feedback.
		See Also: H49-H58, H61-H63, P48, d10, t1-t8

Group	Number Selection	Description	
Function 2 (Cont.)	**H51**	**P Gain for PID** Default: 300 Range: 0 - 999.9%	Access: Tune
		Sets the Proportional gain for the PID Controller.	
		See Also: H40, H50-H56	
	H52	**I Gain for PID** Default: 1.0 Range: 0.1 - 32.0 Sec	Access: Tune
		Sets the Integral gain for the PID Controller.	
		See Also: H49-H58, H61-H63, P48, d10, t1-t8	
	H53	**D Gain for PID** Default: 0.0 Range: 0 - 30.0 Sec	Access: Tune
		Sets the Differential gain for the PID Controller.	
		See Also: H49-H58, H61-H63, P48, d10, t1-t8	
	H54	**PID Control Mode** Default: 0 Range: 0 - 1	Access: R/W
	0	Normal PID Control	
	1	Process PID Control	
		Normal or process PID.	
		See Also: H49-H58, H61-H63, P48, d10, t1-t8	
	H55	**PID output frequency high limit** Default: 60.00 Range: H56 - 400 Hz	Access: Tune
		Limits the output of the PID Controller.	
		See Also: H49-H58, H61-H63, P48, d10, t1-t8	
	H56	**PID output frequency low limit** Default: 0.5 Range: P35 Min, H55 Max	Access: Tune
		Limits the output of the PID Controller.	
		See Also: H49-H58, P48, d10, t1-t8	
	H57	**PID Reference Select** Default: 0 Range: 0 - 4	Access: R/W
	0	Keypad setting 1	
	1	Keypad setting 2	
	2	V1 terminal setting 2: 0-10V	
	3	I terminal setting: 0-20mA	
	4	Setting as a RS485 Communication	
		PID reference source.	
		See Also: H49-H58, H61-H63, P48, d10, t1-t8	

Group	Number Selection	Description
Function 2 (Cont.)	**H58**	**PID Units** Access: R/W Default: 0 Range: 0 - 1
	0	Hertz
	1	Percent
		Hertz or percentage.
		See Also: H49-H58, H61-H63, P48, d10, t1-t8
	H60	**Self Diagnostics Select** Access: R/W Default: 0 Range: 0 - 3
	0	Self-diagnostic disabled
	1	IGBT fault/ground fault
	2	Output phase short & open/ground fault
	3	Ground Fault
		Allows self-diagnostic function.
		See Also: N/A
	H61	**Sleep Delay Time** Access: R/W Default: 60.0 Sec Range: 0 - 2000 Sec
		Sets a sleep delay time in PID drive mode. Do not set Sleep Delay Time for less than the Decel Ramp Time (P42).
		See Also: H49-H58, H61-H63, P48, d10, t1-t8, F72, F73, F74
	H62	**Sleep Frequency** Access: Tune Default: 0.0 Hz Range: 0 - 400 Hz
		Sets a sleep frequency when executing a sleep function in PID mode.
		See Also: H49-H58, H61-H63, P48, d10, t1-t8, F72, F73, F74
	H63	**Wake-Up Level** Access: Tune Default: 35.0% Range: 0 - 100%
		Sets a wake-up level in sleep mode for PID control.
		See Also: H49-H58, H61-H63, P48, d10, t1-t8
	H64	**KEB Drive Select** Access: R/W Default: 0 Range: 0 - 1
	0	Disable
	1	Enable
		When enabled, the drive controls the inverter output and uses the energy from the motor to charge the inverter DC bus voltage.
		See Also: H64-H67, H37

Group	Number Selection	Description
Function 2 (Cont.)	**H65**	**KEB Action Start Level** Access: R/W Default: 125.0% Range: 110 - 140%
		Selects starting point for energy buffering operation.
		See Also: H64-H67, H37
	H66	**KEB Action Stop Level** Access: R/W Default: 130.0% Range: 110 - 145%
		Selects stopping point for energy buffering operation.
		See Also: H64-H67, H37
	H67	**KEB Action Gain** Access: R/W Default: 1000 Range: 1 - 20000
		Sets the gain for the energy buffering operation.
		See Also: H64-H67, H37
	H70	**Frequency Reference for Accel/Decel** Access: R/W Default: 0 Range: 0 - 1
	0	Based on P36 – Frequency High Limit
	1	Based on Delta Frequency
		Set the desired Accel/Decel time in P41 and P42. H70 = 0, the acceleration and deceleration time is the time that it takes to reach maximum frequency from 0 hertz. H70 to 1 = Delta Frequency, Accel/Decel time is the time that it takes to reach target frequency from a constant run frequency (current operating frequency). To scale the time units for accel/decel set parameter H71. 
		See Also: P36, P41, P42, H71

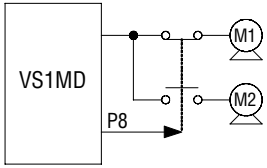
Group	Number Selection	Description
Function 2 (Cont.)	**H71**	**Accel/Decel Time Scale** Access: Tune Default: 1 Range: 1 - 2
	0	Setting Unit: 0.01 sec Range: 0.01- 600.00
	1	Setting Unit: 0.1 sec Range: 0.1- 6000.0
	2	Setting Unit: 1 sec Range: 1- 60000
		This parameter is used to scale the time units for the accel/decel ramp. The display for the VS1MD is available up to 5-digits. Therefore, if time unit is set to 0.01 sec for example, maximum accel/decel time would be 600.00 seconds.
		See Also: N/A
	H72	**Power-On Display** Access: Tune Default: 0 Range: 0 - 0
	0	Speed Command
	1	Motor RPM
	2	Output Current
	3	Output Voltage
	4	Output Power
	5	Output Torque
	6	DC Link Voltage
	7	Digital Input Status
	8	Digital Output Status
	9	Software Version
		Selects the parameter to display on the keypad when power is applied.
		See Also: N/A
	H74	**Gain for Motor RPM Display** Access: Tune Default: 100 Range: 0 - 1000%
		This parameter is used to change the motor RPM display to a scaled custom factor. When H40 = 0 (V/F Control) or 1 (PID Control), the inverter output frequency is displayed in RPM using the following formula. Motor slip is not considered. $RPM = \left(\frac{120 \times f}{P33}\right) \times \frac{H74}{100}$
		See Also: N/A

Group	Number Selection	Description
Function 2 (Cont.)	**H75**	**DB Resistor Select** Access: Tune Default: 1 Range: 0 - 1
	0	Unlimited
	1	Limited by setting in H76
		This parameter is used to scale the time units for the accel/decel ramp. The display for the VS1MD is available up to 5-digits. Therefore, if time unit is set to 0.01 sec for example, maximum accel/decel time would be 600.00 seconds.
		See Also: H76
	H76	**DB Resistor Operating Rate** Access: Tune Default: 10 Range: 0 - 30%
		Sets the percent of DB resistor operating rate to be activated during one sequence of operation. Continuous usage rate is a maximum of 15 seconds. T_acc: Acceleration time to reach a setting freq. T_steady: Time for constant speed operation at setting freq. T_dec: Time to decelerate to lower freq. than that in constant speed or time to stop from freq. in constant speed. T_stop: Waiting time at a stop before operation is resumed. Example 1: $H76 = \left(\frac{T\_dec}{T\_acc + T\_steady + T\_dec + T\_stop} \right) X\ 100\ \%$  Example 2: $H76 = \left(\frac{T\_dec}{T\_dec + T\_steady + T\_acc + T\_steady2} \right) X\ 100\ \%$ 
		See Also: H75

Group	Number Selection	Description
Function 2 (Cont.)	**H77**	**Cooling Fan Control** Access: Tune Default: 0 Range: 0 - 1
	0	Always ON, cooling fan operates when power is applied to drive. Fan turns off when inverter voltage becomes low due to power off.
	1	Fan operates when temp above limit; fan begins to operate when power is ON and a operating command is ON. Fan turns off when operating command is turned off. Fan will continue to operate if the heat sink temperature exceeds a certain limit regardless of operating command. Use this setting for applications requiring frequent starts and stops.
		Sets whether the drive cooling fan will always operate or only when inverter temperature exceeds the temperature limit.
		See Also: H76
	H78	**Operating Method when Cooling Fan Fails** Access: Tune Default: 0 Range: 0 - 1
	0	Continuous operation when cooling fan malfunctions Setting t32 or t33 = 18 (Cooling Fan Fault Alarm) will send an alarm signal to the output)
	1	Control is disabled when cooling fan malfunctions.
		Sets what the drive will do if the cooling fan fails.
		See Also: t32, t33
	H81 - H90	**Second Motor Parameters** Access: See Table Default: N/A Range: Parameters are active when a selected terminal is ON and one of the t1 thru t8 terminals is set to 12 (2nd Motor Select).
		Sets the V/F pattern for the second motor.

Param.	Description	Range	Factory Setting	Adj. run
H81	Accel Time	0 - 6000 Sec	1.0	Tune
H82	Decel Time	0 - 6000 Sec	5.0	Tune
H83	Base Freq	30 - 400 Hz	60.0	R/W
H84	V/F Pattern	0 - 2	0	R/W
H85	FX Torque Boost	0 - 15 %	5	R/W
H86	RX Torque Boost	0 - 15 %	5	R/W
H87	Stall Level	30 - 150 %	150	R/W
H88	1 Min Overload Level	50 - 200 %	150	Tune
H89	Continuous Overload Level	50 - H88 %	100	Tune
H90	Motor Rated Current	0.1 - 50 Amps	Calc	R/W

Use these settings when an inverter operates two motors connected to two different types of loads. 2nd motor operation does not drive two motors at the same time. When first selected motor operation is stopped, select a terminal for the second motor and define H81 thru H90 to run the second motor.



See Also: t1-t8

Group	Number Selection	Description
Function 2 (Cont.)	**H91**	**Parameter Read** Access: R/W Default: 0 Range: 0 - 1
	0	—
	1	Read from drive
		H91 Copies the parameters from the drive and saves them into a remote keypad.
		See Also: N/A
	H92	**Parameter Write** Access: R/W Default: 0 Range: 0 - 1
	0	—
	1	Write to drive
		H92 Copies the saved file in a remote keypad and writes it to the drive.
		See Also: N/A
	H93	**Parameter Initialize** Access: R/W Default: 0 Range: 0 - 5
	0	No Action
	1	All parameters set to factory defaults
		To reset individual groups only and not all parameters select one of the following:
	2	P Group Parameter Reset
	3	F Group Parameter Reset
	4	H Group Parameter Reset
	5	t Group Parameter Reset
		This parameter restores parameter values to their factory settings. Press the Enter/Prog after setting H93. H93 will be displayed again after initialization.
		See Also: N/A
	H94	**Password Register** Access: Tune Default: 0 Range: 0 - 65535
		This parameter is used to assign a password for the drive.
		See Also: H95
	H95	**Password Lock** Access: Tune Default: 0 Range: 0 - 65535
		This parameter is able to lock or unlock parameters by typing the password registered in H94.
		See Also: H94

7.7 Communications Group

Note: Parameters C0 through C36 appear only when a communication card is installed.

Group	Number Selection	Description
Communi-cations	**C0**	**Jump Code** Access: Tune Default: 1 Range: 0 - 99
		See Also: N/A
	C1	**FieldBus Option Name** Access: RO Default: dnEt Range: dnEt, EnEt, PnEt
	dnEt	DeviceNet
	EnEt	Modbus TCP
	PnEt	Profibus DP
		Indicates the type of connected communications card.
		See Also: N/A
	C2	**Software Version** Access: RO Default: — Range: —
		See Also: N/A
	C3	**FieldBus ID** Access: Tune Default: 1 Range: 0 - 63
		Sets the MAC ID of the drive.
		See Also: N/A
	C4	**FieldBus Baud Rate** Access: Tune Default: 125k Range: 125k-500k bps
		Sets the drive to the baud rate used by the connected network. 125kbps, 250kbps or 500 kbps
		See Also: N/A
	C5	**FieldBus LED Status** Access: R/W Default: — Range: —
		See Also: N/A
	C6	**In Instance** Access: R/W Default: 70 Range: 70 - 144
		70, 71, 110, 111, 141-144 Set the value of the "input" instance to be used in Class 0x04 (Assembly Object). As this parameter value is set, the data type to be received (Master-based) at the time of Poll I/O communication is decided. At the time of changing the "input" instance, the communication card is automatically reset.
		See Also: N/A

Group	Number Selection	Description
Communi-cations	**C7**	**Parameter Status Number** Access: R/W Default: 0 Range: 0 - 4
		In the event C6 (in instance) is set to 141-144, the value of C7 (Parameter Status Number) is automatically indicated, and the set value of this parameter varies depending on the set value of C6.
		See Also: N/A
	C8	**Parameter Status 1** Access: Tune Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A
	C9	**Parameter Status 2** Access: Tune Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A
	C10	**Parameter Status 3** Access: Tune Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A
	C11	**Parameter Status 4** Access: Tune Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A
	C16	**Out Instance** Access: R/W Default: 20 Range: 20 - 124
		20, 21, 100, 101, 121-124 Set the value of the "output" instance to be used in the Class 0x04 (Assembly Object). As this parameter value is set, the data type to be sent (Master-based) at the time of Poll I/O communication is decided. At the time of changing the "output" instance, the communication card is automatically reset.
		See Also: N/A
	C17	**Parameter Control Number** Access: R/W Default: 0 Range: 0 - 4
		In the event C16 (out instance) is set to 121-124, the value of C17 (Parameter Control Number) is automatically indicated, and the set value of this parameter varies depending on the set value of C16.
		See Also: N/A
	C18	**Parameter Control 1** Access: R/W Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A

Group	Number Selection	Description
Communi-cations (Cont.)	**C19**	**Parameter Control 2** Access: R/W Default: 0x0000 Range: 0x0000-0xFFFF
		See Also: N/A
	C20	**Parameter Control 3** Access: R/W Default: 0x0000 Range: 0x0000 - 0xFFFF
		See Also: N/A
	C21	**Parameter Control 4** Access: R/W Default: 0x0000 Range: 0x0000 - 0xFFF F
		See Also: N/A
	C26	**Receive Frame Number** Access: RO Default: 0 Range: —
		See Also: N/A
	C27	**Error Frame Number** Access: RO Default: 0 Range: —
		See Also:
	C28	**Nak Frame Number** Access: RO Default: 0 Range: —
		See Also: N/A
	C36	**Communication Update** Access: R/W Default: 0 Range: 0 - 1
	0	No
	1	Yes
		Used when initializing the communication card. Set C36 = 1(Yes) carries out an initialization and then automatically displays "0(No)".
		See Also: N/A

8.1 Frequency Mode

8.1.1 Keypad Frequency Setting 1

Table 8-1 Keypad Frequency Setting 1

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Frequency Command]	-	Hz
	P40	[Speed Reference Source]	1	
Step 1. Set P40 [Speed Reference Source] = 1.				
Step 2. Set the desired frequency in P37 and press the Prog/Ent key to save the value into memory.				

Note: The value can not be set above P36 [Frequency High Limit].
Note: When a remote keypad is connected, keypad keys at the drive are deactivated.

8.1.2 Keypad Frequency Setting 2

Table 8-2 Keypad Frequency Setting 2

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Frequency Command]	-	Hz
	P40	[Speed Reference Source]	1	
Step 1. Set P40 [Speed Reference Source] = 1.				
Step 2. Set the Up (▲) / Down (▼) key. The Up/Down keys serve as a potentiometer to dynamically change the value in P37 [Frequency Command].				

Note: The value cannot be set above P36 [Frequency High Limit].
Note: When a remote keypad is connected, keypad keys at the drive are deactivated.

8.1.3 Frequency Setting using the -10 to 10V Input

Table 8-3 Frequency Setting using the -10 to 10V Input

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Frequency Command]	-	Hz
	P40	[Speed Reference Source]	2	
Terminal Group	t36	[NV Input Minimum Voltage]	-	V
	t37	[Frequency Corresponding to t36]	-	Hz
	t38	[NV Input Max Voltage]	-	V
	t39	[Frequency Corresponding to t38]	-	Hz
	t40 to t44	[V1 Input]		
Step 1. Set P40 [Speed Reference Source] =2.				
Note: The set frequency can be monitored in do [Frequency Command].				

Figure 8-1 Frequency Setting using the 10V Input

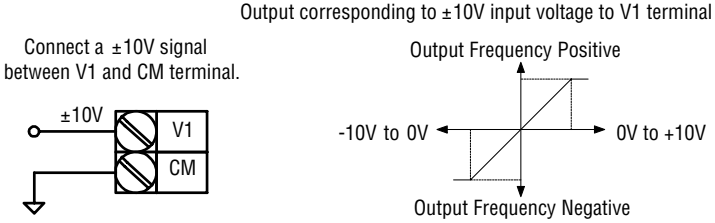
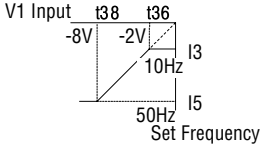
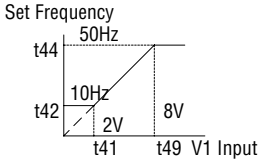


Table 8-4

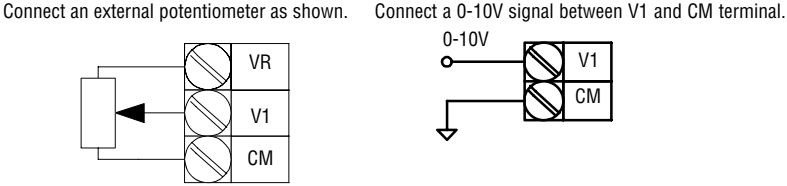
t36 to t39: Setting input range and corresponding frequency to - 10V to 0V V1 input voltage Ex) when minimum (-) input voltage is -2V with corresponding frequency 10Hz and Max voltage is –8V with run freq. 50Hz.	
t40 to t44: Setting input range and corresponding frequency to 0 to +10V V1 input voltage Ex) when minimum (+) input voltage is 2V with corresponding frequency 10Hz and Max voltage is 8V with run freq.	

8.1.4 Frequency Setting using 0 to 10V Input Terminal or Potentiometer

Table 8-5 Frequency Setting using 0 to 10V Input Terminal or Potentiometer

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Speed Command]	-	Hz
	P40	[Speed Reference Source]	3	
Terminal Group	t40	Filter Time Constant for V1 Input]	10	
	t41	[V1 Input Min Voltage]	-	V
	t42	[Frequency corresponding to I7]	-	Hz
	t43	[V1 Input Max Voltage]	-	V
	t44	[Frequency Corresponding to I9]	-	Hz
Step 1. Set P40 [Speed Reference Source] to “3”. **Note**: 0- 10V can be directly applied from an external controller or a potentiometer connected at terminals VR, V1 and CM.				

Figure 8-2 Frequency Setting using 0 to 10V Input Terminal or Potentiometer



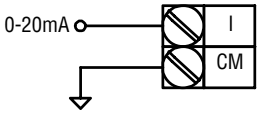
8.1.5 Frequency Setting using 0-20mA Input

Table 8-6 Frequency Setting using 0-20mA Input

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Speed Command]	-	Hz
	P40	[Speed Reference Source]	4	
Terminal Group	t45	[Filter Time Constant for I Input]	10	
	t46	[I Input Minimum Current]	-	mA
	t47	[Frequency Corresponding to I12]	-	Hz
	t48	[I input Max Current]	-	mA
	t49	[Frequency Corresponding to I14]	-	Hz
Step 1. Set P40 [Speed Reference Source] to “4”.				
Note: Frequency is set by 0 to 20mA input between I and CM terminal.				

Figure 8-3 Frequency Setting using 0-20mA Input

Connect a 0-20mA Current source signal between I and CM terminal.



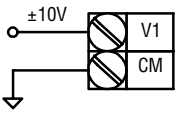
8.1.6 Frequency Setting using +/-10V Input and 0-20mA Input

Table 8-7 Frequency Setting using 10V Input and 0-20mA Input

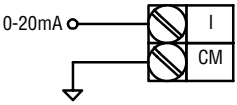
Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Speed Command]	-	Hz
	P40	[Speed Reference Source]	5	
Terminal Group	t45	[Filter Time Constant for I Input]	10	
	t46	[I Input Minimum Current]	-	mA
	t47	[Frequency Corresponding to I12]	-	Hz
	t48	[I Input Max Current]	-	mA
	t49	[Frequency Corresponding to I14]	-	Hz
Step 1. Set P40 [Speed Reference Source] to “5”.				
Note: Override function available using Main/Auxiliary speed adjustment.				
Note: Related code: t36, t39, t40, t44, t45, t49				

Figure 8-4 Frequency Setting using 10V Input and 0-20mA Input

Connect a ±10V signal between V1 and CM terminal.



Connect a 0-20mA Current source signal between I and CM terminal.



Override allows more precise control and a faster response by combining Main and Auxiliary speed inputs. Fast response can be achieved using Main speed and precise control can be accomplished by Aux. speed if the accuracy of Main/Aux speed is set differently.
Note: Use these settings when Main speed is 0-20mA and Aux. speed is V1 terminal (±10V).

Table 8-8 Use these settings when Main speed is 0-20mA and Aux. speed is V1 terminal (±10V)

Group	Code	Parameter Name	Setting	Unit
Terminal Group	t36	[NV Input Minimum Voltage]	0	V
	t37	[Frequency Corresponding to t36]	0.00	Hz
	t38	[NV Input Max Voltage]	10.00	V
	t39	[Frequency Corresponding to t38]	5.00	Hz
	t41	[V1 Input Min Voltage]	0	V
	t42	[Frequency Corresponding to t41]	0.00	Hz
	t43	[V1 Input Max Voltage]	10	V
	t44	[Frequency Corresponding to t43]	5.00	Hz
	t46	[I Input Minimum Current]	4	mA
	t47	[Frequency Corresponding to t46]	0.00	Hz
	t48	[I Input Max Current]	20	mA
	t49	[Frequency Corresponding to t48]	60.00	Hz

Note: After these parameters are set, if +5V is applied to V1 with 12mA at terminal I, the output frequency would be 32.5Hz. If -5V is applied to V1 terminal with 12mA at terminal I, the output frequency would be 27.5Hz.

8.1.7 Frequency Setting using the 0 to 10V Input and 0-20mA Input

Table 8-9 Frequency Setting using the 0 to 10V Input and 0-20mA Input

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Speed Command]	0.00	Hz
	P40	[Speed Reference Source]	6	
Step 1. Set P40 [Speed Reference Source] to “6”. **Note:** Related code: t40 to t44, t45 to t49 **Note:** Refer to Frequency setting using ±10V voltage input and 0-20mA input.				

8.1.8 Frequency Setting using the RS485 Communication

Table 8-10 Frequency Setting using the RS485 Communication

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P37	[Speed Command]	0.00	Hz
	P40	[Speed Reference Source]	7	
Step 1. Set P40 [Speed Reference Source] to “7”. **Note:** Related code: t59 - t61 **Note:** Refer to Appendix E. RS485 communication.				

8.1.9 Rotating Direction Selection using +/-10V Input on V1 Terminal

Table 8-11 Rotating Direction Selection using 10V Input on V1 Terminal

Group	Code	Parameter Name	Setting	Unit
Parameter Group	P38	[Drive Mode]	-	
	P40	[Speed Reference Source]	2	
Terminal Group	t59	[Communication Protocol Selection]	-	
	t60	[Inverter Number]	-	
	t61	[Baud Rate]	-	
Step 1. Set P40 to "2". **Note:** Regardless of Drive mode setting, the Inverter is operating as follows:				
		FWD Run Command	REV Run Command	
0 to +10V		FWD Run	REV Run	
-10 to 0V		REV Run	FWD Run	

Motor runs in Forward direction with +input voltage at V1 and FWD RUN command is active.
Motor runs in Reverse direction with -input voltage at V1 and FWD RUN command is active.
Motor runs in Reverse direction with +input voltage at V1 and REV RUN command is active.
Motor runs in Forward direction with +input voltage at V1 and REV RUN command is active.
When motor direction is changed, the motor decels to stop before running in the new direction.

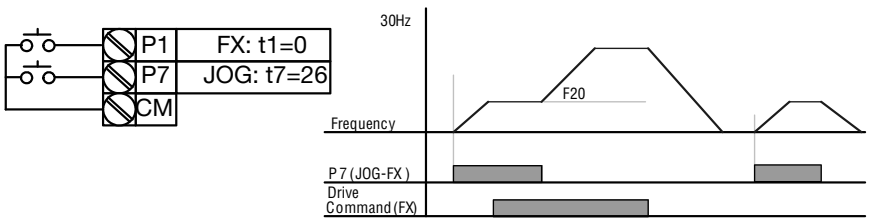
8.2 Jog Forward/Reverse Operation

Table 8-12 Terminal JOG FX/RX operation

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function Group 1	F20	Jog Frequency	-	0 - 400	10.00	Hz
Terminal Group	t7	Digital Inputs 1-8	26	0 - 28	6	
	t8	Digital Inputs 1-8	27	0 - 28	7	

Step 1. Set the desired jog frequency in F20.
Step 2. Select a terminal from P1 - P8 to use for this setting.
Step 3. Define a digital input as either 26 (Jog Forward) or 27 (Jog Reverse).
Note: If P7 is set for Jog operation, set t7 to 26 (Jog Forward).
Jog frequency's range can be set between frequency high limit (P36) and start frequency (F67).
The following diagram is an example when reference frequency is 30Hz and Jog frequency is 10 Hz

Figure 8-5 Jog Operation-Reference Frequency 30Hz/Jog Frequency 10Hz



8.3 MOP Function

8.3.1 MOP Up/Down Mode Select

Table 8-13 MOP Up/Down Mode Select

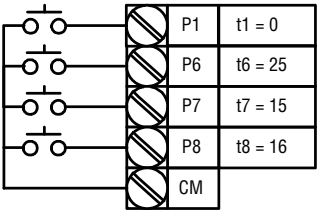
Group	Display	Parameter Name	Setting	Range	Default	Unit
Program Group	P40	Speed Reference Source	8	1 - 8	1	
Terminal Group	t1	Digital Input 1	0	0 - 28	0	
	t7	Digital Input 7	15		6	
	t8	Digital Input 8	16		7	
Function Group 1	F65	Up/Down Mode Select	-	0 - 2	0	
	F66	Up/Down Step Frequency	-	0 - 400	0.00	Hz

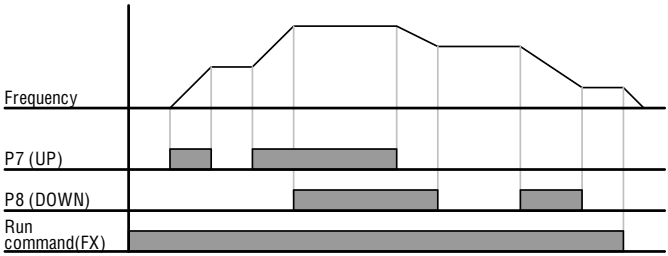
Set P40 [Speed Reference Source] = 8 to assign the speed reference to be from an MOP input. Assign one terminal among P1 to P8 for Frequency Increase (UP) and one terminal as the Frequency Decrease (DOWN) function. If you select P7 and P8 as the Increase/Decrease terminals, set t7 = 15 (Frequency Increase) and t8 = 16 (Frequency Decrease) in the terminal programming group.

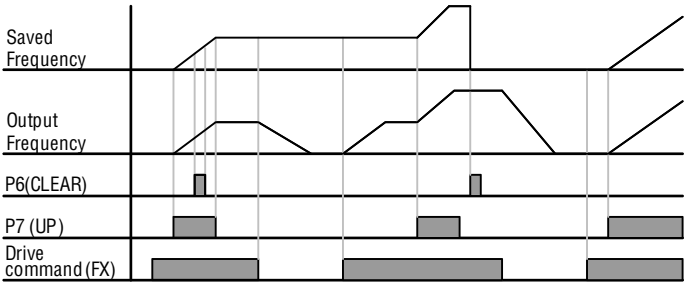
The rate of change for the MOP frequency is based on the P41 (Acceleration Ramp) for Frequency Increase (UP) and theP42 (Deceleration Ramp) for Frequency Decrease (DOWN).
The Frequency Increase/Frequency Decrease function can be set as follows:

F65	Up/Down Mode Select	0	The reference frequency is changed between the ranges of the P35 (Frequency Low Limit) and P36 (Frequency High Limit) settings
		1	Increase or decrease speed after an edge input in frequency increments set by F66
		2	Combination of 0 and 1
F66	Up/Down Step Frequency	Frequency increased according to edge input	

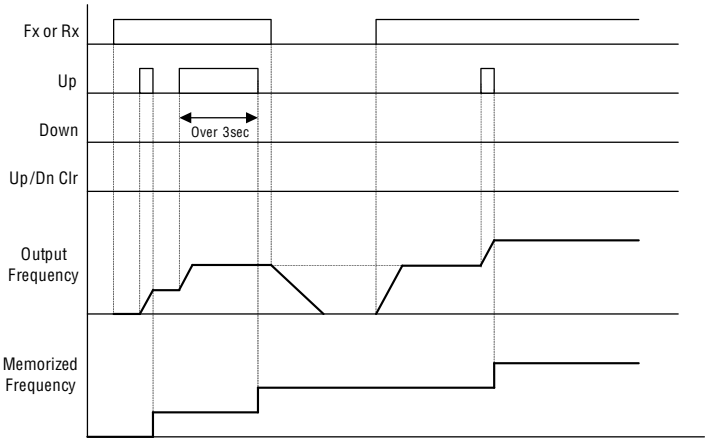
When F65 is 0: If you close the UP input, speed will increase to the upper limit. If you press DOWN, speed will decrease to the lower limit regardless of stop method.



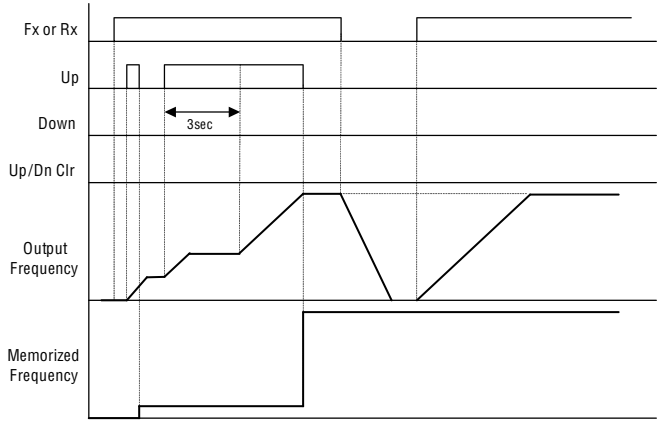




When F65 is 1: Speed will increase or decrease in increments each time an edge input is received. The step value change is set in F66. Frequency is saved at the falling edge. While a digital input is set as UP or DOWN, if a stop command is received, the previous falling edge value is saved. If a digital input is not defined to save the MOP value, the last is not saved on a stop command.



When F65 is 2: The MOP function will operate per the F65 setting = 1, however if an input is held active for 3 second, the MOP function will operate per the F65 setting = 0.



8.3.2 MOP Up/Down Value Save Function

Table 8-14 MOP Up/Down Save Function

Group	Display	Parameter Name	Setting	Range	Default	Unit
Drive Group	P40	Speed Reference Source	8	0-8	0	
	t1	Digital Input 1	0	0 - 27	0	
Terminal Group	t6	Digital Input 6	25		5	
	t7	Digital Input 7	15		6	
	t8	Digital Input 8	16		7	
Function Group 1	F63	MOP Frequency Save Initialization	-	0-1	0	
	F64	MOP Frequency Saved Value	-		0.00	

Set P40 [Speed Reference Source] = 8 to assign the speed reference to be from an MOP input. Assign one terminal among P1 to P8 for Frequency Increase (UP) and one terminal as the Frequency Decrease (DOWN) function. If you select P7 and P8 as the Increase/Decrease terminals, set t7 = 15 (Frequency Increase) and t8 = 16 (Frequency Decrease) in the terminal programming group. The rate of change for the MOP frequency is based on the P41 (Acceleration Ramp) for Frequency Increase (UP) and theP42 (Deceleration Ramp) for Frequency Decrease (DOWN).

If you select the P6 terminal as the up-down save terminal, set this parameter = 25.

Up/down Save function: If F63, 'Save up/down frequency', is set to 1, the frequency before the inverter was stopped or decelerated is saved in F64. While up-down save operates, the user can initialize the saved up-down frequency by setting multi-function input terminal as a up-down frequency save initialization.

F63	Save Up/Down Frequency Select	0	Remove 'Save Up/Down Frequency'
		1	Set 'Save Up/Down Frequency'
F64	Save Up/Down Frequency	Up/Down Frequency Saved	

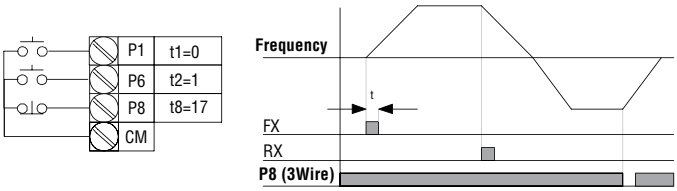
If 'Up/Down Save Frequency Initialization' signal is input while the multi-function input 'Up' or 'Down' function is applied, this signal is ignored.

8.4 3Wire

Table 8-15 3Wire

Group	Code	Parameter Name	Setting
Terminal Group	t1	[Digital Input1 - P1] Forward Run Command	0
	t6	[Digital Input6 - P6] Reverse Run Command	
	t8	[Digital Input8 - P8] Stop	17
Select the terminal from P1- P8 for use as 3- Wire operation. If P8 is selected, set t8 to “17”<?> [3- Wire Stop].			

Figure 8-6 3Wire



Input signal is saved in 3- Wire operation. Therefore, inverter can be operated by momentary switch. Pulse t should not be less than 50msec.

8.5 Timer Operation

Table 8-16 Timer Operation

Group	Display	Parameter Name	Setting	Range	Default	Unit
Terminal Group	t54	Timer Value	-	0 -3,600	5	Sec
	t1 - t8	Digital Inputs 1-8	13	0 - 28	-	-
	t1 - t8	Digital Inputs 1-8	14	0 - 28	-	-
	t1 - t8	Digital Inputs 1-8	28	0 - 28	-	-
	t32	Digital Output (MO)	20	0 - 20	12	
	t33	Relay Output (3A – 3C)	20	0 - 20	17	

Set the desired terminal from P1 to P8 to start the timer.
Setting = 13 runs the timer as long as the digital input is maintained.
Setting = 14 starts the timer on a momentary input.
Closing any digital input programmed as 28 will reset the timer back to a zero value.
When the timer reaches its programmed value set in t54, the state of either the MO or Relay Output will change when either is set to a value of 20.

8.6 PID Control

Table 8-17 PID Control

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function Group 2	H49	PID Control Select	0	0 - 1	0	-
	H50	PID Feedback Select	-	0 - 1	0	-
	H51	P Gain for PID Controller	-	0 - 999.9	300.0	%
	H52	Integral Time for PID Controller (I Gain)	-	0.1 - 32.0	1.0	sec
	H53	Differential Time for PID Controller (D Gain)	-	0.0 - 30.0	0	sec
	H54	PID Mode Select	-	0 - 1	0	-
	H55	PID Output Frequency High Limit	-	0.1 - 400	60.0	Hz
	H56	PID Output Frequency Low Limit	-	0.1 - 400	0.50	Hz
	H57	PID Reference Select	-	0 - 4	0	Hz
	H58	PID Unit Select	-	0 - 1	0	-
	H61	Sleep Delay Time	-	0.0-2000.0	60.0	-
	H62	Sleep Frequency	-	0.00 - 400	0.00	Hz
	H63	Wake-Up Level	-	0.0 -100.0	35.0	%
Terminal Group	t1 - t8	Digital Input 1-8	21	0 - 28	-	-
Parameter Group	P48	PID Reference	-	0 - 400 / 0 - 100	0.00 / 0.0	Hz / %
Display Group	d10	PID Feedback	-	0 - 400 / 0 - 100	0.00 / 0.0	Hz / %
Function Group 1	F72	Sleep Mode Boost Enable	0	0 - 1	0	-
	F73	Sleep Mode Boost Time	-	0 - 120	10	Sec
	F74	Sleep Mode Boost Frequency	-	0 - Max Frequency	30	Hz

Output frequency of the inverter is controlled by the PID loop for use as constant control of flow, pressure or temperature. Select H49 as a 1 (PID drive select), parameters P48 and d10 will then be viewable. Set PID reference value in P48 and the real time PID feedback amount can be monitored in d10. There are two modes for PID, Normal PID mode and Process PID mode, set in H54 (PID mode select).

8.6.1 PID Control Parameters

H50: Select the feedback source for the PID controller.

H50	PID Feedback select	0	Terminal I input 0 - 20mA
		1	Terminal V1 input 0 - 10V

H51: Set the percentage of output to error. If P Gain is set to 50%, 50% of the error value will be outputted. Setting a higher value results in reaching the target control value faster but it may cause oscillation.

H52: Set the time to output the accumulated error value. Set the time required to output 100% when the error value is 100%. If H52 - Integral time for PID controller (I gain) is set to 1 sec and the error becomes 100%, 100% will be then be outputted in 1 sec. Adjusting the value may reduce the nominal error. If the value is reduced, response will be faster but may lead to controller oscillation.

H53: Set the output value to the variation of the error. The error is detected within 0.01 seconds by the controller. If differential time is set to 0.01 sec and the percentage variation of error per 1 sec is 100%, 1% per 10msec is outputted.

H54: PID Control Mode Select. Selects Normal or Process PID Control (See sections 8.6.2 & 8.6.3)

H55, H56: Limits the output of the PID controller.

H57: Selects PID Reference.

H58: PID Reference and PID feedback's units are classified as two which is [Hz] and [%]. H58=0: [Hz], H58=1: [%]

t1 - t8: To exchange PID to normal operation, set one of P1-P8 terminal to 21 and close the input.

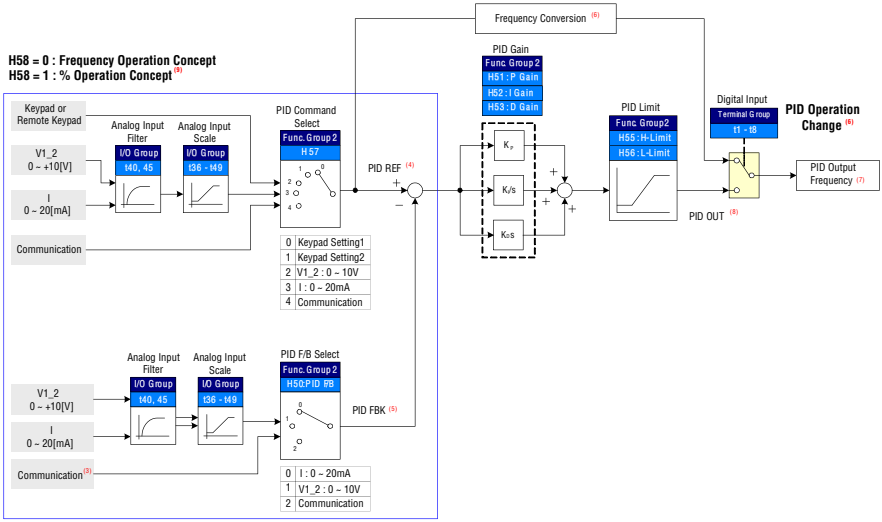
d1: Calculates the feedback from H50 into Motor frequency and displays it.

P48: Indicates PID controller's command value.

d10: Converts feedback amount set in H50 to motor frequency.

8.6.2 Normal PID Control Diagram (H54=0)

Figure 8-7 Normal PID Control Diagram (H54=0)

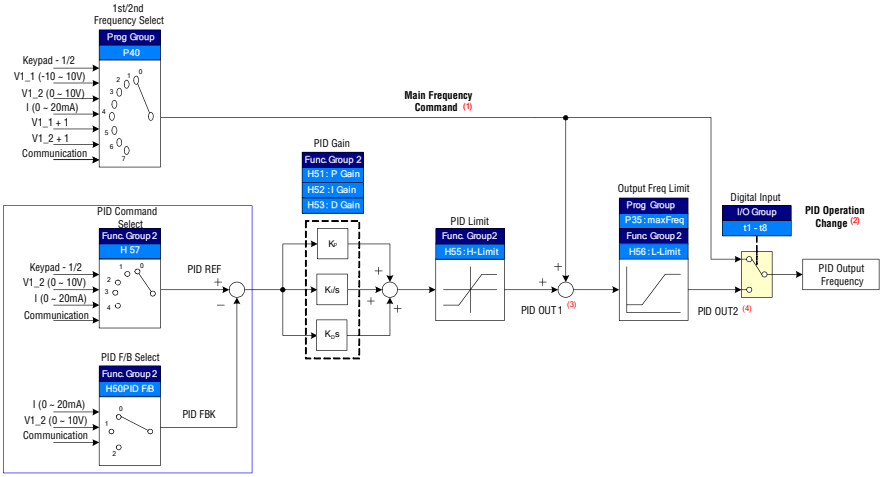


(3) Adds RS485 communications to PID Feedback category.
(4) PID REF value can be changed and checked in "P48" of the Program group. Units are in [Hz] when H58=0 and [%] when H58=1

(5) PID FBK value can be checked in the “d10” of the Display group. Unit is same with the “P48”
(6) If PID switching is inputted to digital inputs (P1-P8), with H58 = 1, [%] is converted into [Hz].
(7) Output frequency is displayed in the operation mode.
(8) PID OUT of Normal PID is single polarity and it is limited by H55 (H-Limit) and H56 (L-Limit).
(9) 100% is P36 (Frequency High Limit)

8.6.3 Process PID Control Diagram (H54=1)

Figure 8-8 Process PID Control Diagram (H54=1)

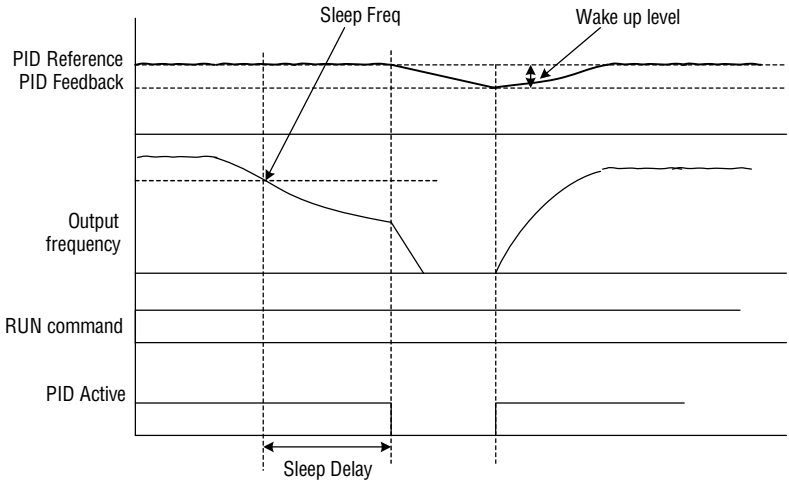


(1) Speed command is the frequency set by P40/P47 (except P40=8, Up/Down) and real output frequency is the sum of speed command, PID OUT1 and PID OUT2.
(2) If PID switching drive is selected
(3) PID OUT1’s polarity is double. It is limited H55 (PID upper Limit).
(4) Real output frequency PID OUT2 is limited by P36 (Frequency High Limit) and H56 (PID lower Limit).

8.6.4 Sleep and Wake-Up

If output frequency of the PID control is maintained for a period of time set in H61 (Sleep delay time), the sleep function activates and the drive goes into sleep mode automatically (inverter will stop). **Note: Sleep Delay Time (H61) must not be set less than the Decel Ramp Time (P42).** A momentary boost in frequency (F72 & F74) can also be added for a period of time (F73) prior to the drive going to sleep (for pressurizing a system, topping off a tank, etc.) Under sleep mode, if the error between the PID Reference and Feedback exceeds the value set in H63 (Wake-up Level), Sleep mode is released and the inverter restarts.
Any valid stop command will also release sleep mode.

Figure 8-9 Sleep & Wake-Up



8.7 Frequency Setting and 2nd Drive Method Select

Table 8-18 Frequency Setting and 2nd Drive Method Select

Group	Display	Parameter Name	Setting	Range	Default	Unit
Program Group	P38	Start/Stop Source 1	-	0 - 3	1	-
	P40	Speed Reference Source 1	-	0 - 8	0	-
	P46	Start/Stop Source 2	-	0 - 3	1	
	P47	Speed Reference Source 2	-	0 - 7	0	
Terminal Group	t1-t8	Digital Input 1-8	-	0 - 28		sec

Set a digital input as 22 (exchange between second source and drive). Closing this digital input selects a 2nd source for the Start/Stop and Speed Reference defined in parameters P46 and P47. When a communication network is used as the main control source, this function selects where the control source will come from when the communication link is terminated.

The switching method for Drive mode 1 and Drive mode 2 is as follows:
If a digital input terminal set as Drive mode 2 is off, the control uses Drive mode 1.
If a digital input terminal set as Drive mode 2 is on, the control uses Drive mode 2.

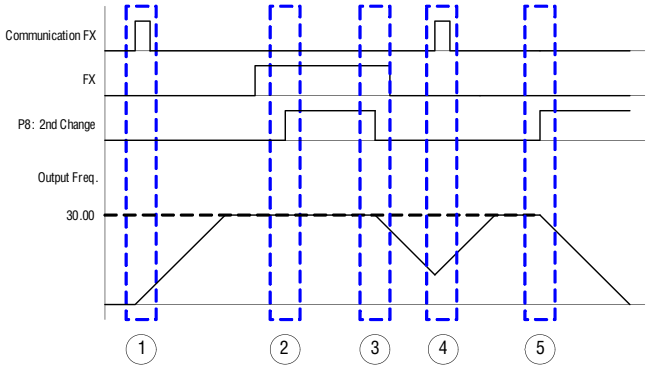
P46	Start/Stop Source 2	0	Operation via Run/Stop key on the Keypad	
		1	Terminal Operation	FX: Forward Run Command
				RX: Reverse Run Command
		2		RX: Forward/Reverse Command
				FX: Run/Stop Command
		3	Operation via RS485 Communication (see Appendix E)	
		4	Operation via Communication Network	
P47	Speed Reference Source 2	1	Digital	Keypad Digital Frequency Mode
		2	Analog	V1 terminal setting1: -10 - +10V
		3		V1 terminal setting2: 0 - +10V
		4		I terminal: 0 - 20mA
		5		V1 terminal setting1 + I terminal
		6		V1 terminal setting2 + I terminal
		7	Setting via RS485 Communication (see Appendix E)	
		8	Setting via Communication Nnetwork	

The following is example for switching between P38 and P46.

Table 8-19 Example for Switching Between P38 and P46

Group	Display	Parameter Name	Setting	Range	Default	Unit
Program Group	P38	Start/Stop Source 1	3	0 - 3	0	-
	P40	Speed Reference Source 1	-	1 - 8	1	-
	P46	Start/Stop Source 2	1	0 - 3	1	
	P47	Speed Reference Source 2	-	1 - 7	1	
Terminal Group	t8	Input terminal P8 define	22	0 - 28	7	

The following figure represents the above settings and a speed reference of 30Hz, P39 (Stop Method) = 0



CAUTION: **If you press START while a digital input terminal (P1 - P8) is set to the 2nd Source, the speed reference and drive start/stop source will be from the Drive mode 2 parameters.**

8.8 Over Voltage Trip Protection – Power Braking

Table 8-20 Over Voltage Trip Protection – Power Braking

Group	Display	Parameter Name	Setting	Range	Default	Unit
Program Group	P39	Stop Type	3	0 - 3	0	
Function Group	F59	BIT 0: stall prevention under acceleration	-	0 - 7	0	
		BIT 1: stall prevention during constant speed operation				
		BIT 2: stall prevention under deceleration				
	F61	Select voltage limit under deceleration	-	0 - 1	0	

To prevent an over voltage trip when reducing speed, set BIT2 of F59 to 1 and set P39 = 3 to enable the power braking function. The drive will use the regenerative braking power to prevent over voltage trips when speed is reduced, either because of a speed reference change or a ramp to a stop command.

Power Braking: When the inverter's DC BUS voltage rises above a set level, the deceleration or acceleration ramp rate is adjusted to prevent over voltage trips. This can be used when a short deceleration ramp is needed and no braking resistor is used. The actual deceleration ramp time may be longer than the set time if BUS voltage rises above the set value.

CAUTION: **Stall prevention and Power Braking only operate when decelerating, and Power Braking has the priority. That is, when BIT2 of F59 and Power Braking of P39 are both set, Power Braking operates. F61 (selecting voltage restriction when decelerating) is visible when BIT2 of F59 is set. Over voltage trip may occur if the deceleration time is too short or the inertia too big.**

8.9 External Brake Control

Table 8-21 External Brake Control

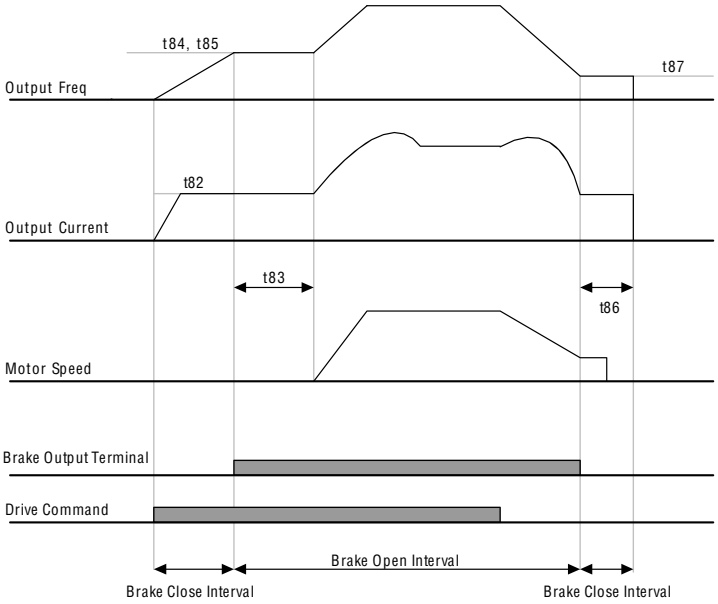
Group	Display	Parameter Name	Setting	Range	Default	Unit
Function 2	H40	Controlling Method Select	0	0-3	0	
In/Output Group	t82	Brake Open Current	-	0-180.0	50.0	%
	t83	Brake Open Delay Time	-	0-10.00	1.00	Sec.
	t84	Brake Open CW Frequency	-	0-400	1.00	Hz
	t85	Brake Open CCW Frequency	-	0-400	1.00	Hz
	t86	Brake Close Delay Time	-	0-10.00	1.00	Sec.
	t87	Brake Close Frequency	-	0-400	2.00	Hz
	t54	Multi-Function Output Terminal Select	19	0- 19	12	
	t55	Multi-Function Relay Select	19	0- 19	17	

Parameters t82 to t87 are only visible when t32 or t33 is set to 19. These parameters are used to control the on/off operation of an electronic brake. This function only operates when H40 is set to 0 (V/F Control). When brake control is in operation, DC brake and dwell run do not operate.

Brake Open Sequence
When the electric motor is given instructions to run, the inverter accelerates CW or CCW to the brake open frequency (t84, t85). After reaching the brake open frequency, the current running through the motor reaches brake open current (t82) and puts out brake open signals to the multi-function output terminals or output relays that are set for brake control.

Brake Close Sequence
During run, the electric motor decelerates when a stop instruction is given. When the output frequency reaches brake close frequency, it stops decelerating and puts out the brake close signal to the set output terminal. Frequency turns “0” after keeping the frequency for brake close delay time (t86).

Figure 8-10 In Case of V/F Constant Control on Control Mode Select



CAUTION: **External Brake control is only used in V/F uniform control, and the brake open frequency has to be set smaller than close frequency.**

8.10 Kinetic Energy Buffering (KEB)

Table 8-22 Kinetic Energy Buffering (KEB)

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function 2	H64	KEB Operation Select	1	0-1	0	
	H65	KEB Operation Start Level	-	110.0 -140.0	130.0	-
	H66	KEB Operation Stop Level	-	110.0 -145.0	135.0	%
	H67	KEB Operation Gain	-	1 - 20000	1000	-
	H37	Load Inertia	0	0-2	0	-

When a power failure occurs and the drive looses input power, the load will draw down the dc bus voltage, causing a low voltage fault. The function of KEB is to maintain the dc bus voltage by controlling the output frequency of the inverter during the power failure. In so doing, it can extend the time from the point of power failure to low voltage defect occurrence.
If H64 is set to 0, the drive operates normally and decelerates until a low voltage occurs.

When H64 is set to 1, the drive controls the inverter output frequency and uses the energy from the motor to charge the inverter DC bus voltage.

H65 (KEB operation start level), H66 (KEB operation stop level): Selects starting and stopping point of the energy buffering operation. Set the stop level H65 higher than the start level H66 and set the low voltage defect level as standard.

H37 (Load inertia): Uses the load inertia momentum to control energy buffering operation.

8.11 Draw Control

Table 8-23 Draw Control

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function 1	F70	Draw Mode Select	-	0 - 3	0	-
	F71	Draw Ratio	-	0.0 -100.0	0.0	%

Open loop tension control using the speed difference between the main frequency command and the draw input to keep material's tension steady.

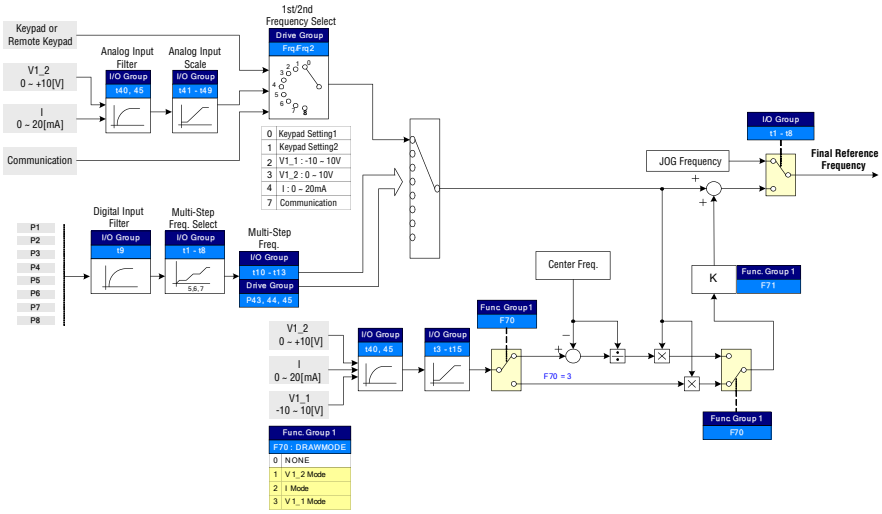
The ratio reflected in the output frequency differs according to the selection of F70 (Draw mode select).

F70	Draw Operation	0	Draw not operated
		1	V1(0-10V) Input Draw Operation
		2	I(0-20mA) Input Draw Operation
		3	V1(-10-10V) Input Draw Operation

Select 1 and 2 for F70
The center value of the analog input (selected by the set value of I6-I15) as standard, if the input is big it gets (+), if small (-) and gets reflected in the output frequency as the ratio set in F71.

Select 3 for F70
0V as standard, if analog input voltage is big, it gets (+), if small (-) and gets reflected in the output frequency as the ratio set in F71.

Figure 8-11 Draw Control



8.12 Single Phase PWM Control

Table 8-24 Single Phase PWM Control

Group	Display	Parameter Name	Setting	Range	Default	Unit
Function 2	H48	PWM Controlling Mode 0: Normal PWM 1: Single Phase PWM	1	0 - 1	0	

Heat loss and leakage current from inverter can be reduced when H48 is set to 1 (Single Phase PWM).

8.13 Auto Tune

Be sure to remove load from motor shaft before auto tune. The shaft must move freely and unloaded during this procedure.

Table 8-25 Auto Tune

Group	Code	Parameter Name	Setting	Unit
Function 2 (High)	H41	[Auto Tune]	1	
	H42	[PID Feedback Selection]	-	W
	H44	[P Gain for PID Controller]	-	mH
Motor parameters will be automatically measured. The measured motor parameters in H41 can be used in Auto Torque Boost and Sensorless Vector Control.				

H41: When H41 is set to 1 and press the Enter/Prog key, Auto tuning is activated and “TUn“ will appear on the LED keypad. When finished, “H41“ will be displayed.

H42, H44: The values of motor stator resistance and leakage inductance detected in H41 are displayed, respectively. When Auto tuning is skipped or H93 - [Parameter initialize] is done, the default value corresponding to motor type (H30) will be displayed. Press the STOP/RST key on the keypad or turn on the EST terminal to stop the Auto Tuning. If Auto tuning of H42 and H44 is interrupted, the default value will be set. If H42 and H44 are finished and auto-tuning of leakage inductance is interrupted, the measured value of H42 and H44 are used and the default of leakage inductance is set.

Be sure accurate values are entered for stator resistance and leakage inductance. Otherwise, the performance of Sensorless vector control and Auto torque boost could be compromised.

8.14 Sensorless Vector Control

Table 8-26 Sensorless Vector Control

Group	Code	Parameter Name	Setting	Unit
Parameter	P30	[Motor HP Select]		HP
	P32	[Motor Rated Current]	-	A
Function 1	F14	[Time for Energizing a Motor]		sec
Function 2	H32	[Rated Slip Frequency]	-	Hz
	H34	[Motor No Load Current]	-	A
	H40	[Control Mode Select]	3	
	H42	[Stator Resistance]	-	Ω
	H44	[Leakage Inductance]	-	mH

Ensure that the following parameters are entered correctly for optimal performance in Sensorless vector control.

P30: Select motor HP connected to inverter output.

P32: Enter motor nameplate rated current.

F14: This parameter accelerates the motor after pre-exciting the motor for the set time. The amount of the pre-exciting current is set in H34[Motor No Load Current]. Directly enter the motor nameplate value except motor rating when 0.2kW is used.

H32: Enter rated slip frequency based on motor nameplate RPM and rated frequency.

H34: After removing the load, set H40[Control mode Selection] to “0“ [V/F control] and run the motor at 60Hz. Enter the current displayed in Cur-[Output current] as motor no load current. If it is difficult to remove the load from the motor shaft, enter a value equal to 40 to 50% of H33[Motor rated current] or the factory default.

H40: A value of “3” selects Sensorless Vector Control.

H42, H44: Enter the value of the parameter measured during H41[Auto tuning] or the factory default.

8.15 Speed Search

Table 8-27 Speed Search

Group	Code	Parameter Name	Setting	Unit
Function 2 (High)	H22	[Speed Search Selection]	-	
	H23	[Current Level]	-	%
	H24	[Speed Search P Gain]	-	
	H25	[Speed Search I Gain]	-	
Terminal Group	t32	[Digital Output Terminal Selection]	15	
	t33	[Relay Output Selection]	15	

Prevents possible faults from occurring if the inverter outputs the voltage during operation after the load is removed.
The inverter estimates the motor RPM based on output current. Therefore, detecting exact speed is difficult.

Table 8-28 Types of Speed Search Selections

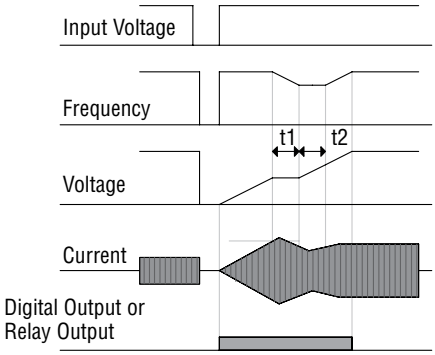
Parameter	Value	Speed Search During H20 [Power On Start]	Speed Search During Instant Power Failure Restart	Speed Search During H21 [Restart after Fault Reset]	Speed Search During Acceleration
		Bit 3	Bit 2	Bit 1	Bit 0
H22	0	-	-	-	-
	1	-	-	-	√
	2	-	-	√	-
	3	-	-	√	√
	4	-	√	-	-
	5	-	√	-	√
	6	-	√	√	-
	7	-	√	√	√
	8	√	-	-	-
	9	√	-	-	√
	10	√	-	√	-
	11	√	-	√	√
	12	√	√	-	-
	13	√	√	-	√
	14	√	√	√	-
	15	√	√	√	√

H23: Limits current during Speed search. Set as a percentage of H33.

H24, H25: Speed search is activated by PI control.
Adjust P gain and I gain corresponding to the load characteristics.

t32, t33: Signal of active Speed search is given to external sequence by Digital output terminal (MO) and Relay output (3A-C).

Figure 8-12 Example Speed Search During Instant Power Failure Restart



- When the input power is cut off due to instant power failure, the inverter outputs Low voltage trip (LV) to hold the output.
- When the power is restored, the inverter outputs the frequency before the low voltage trip and the voltage is increased due to PI control.
- t1: If current is increasing over the preset level in H23, the rise in voltage will stop and the frequency is decreased.
- t2: If the opposite of t1 occurs, the increase in voltage starts again and the decrease in frequency stops.
- When the frequency and voltage are restored back to the nominal level, acceleration will continue at the frequency before trip.

Speed search operation is suitable for loads with high inertia. Stop the motor and restart when friction in load is high.

VS1MD keeps normal operation when instant power failure occurs and power is restored in 15msec for the use of its inverter rating.

Inverter DC link voltage can vary depending on output load quantity. Therefore, Low Voltage trip may occur when instant power failure is maintained over 15msec or output is higher than its rating.

Instant power failure specification is applied when input voltage to Inverter is 200 to 230VAC for 200V class, or 380 to 480VAC for 400V class.

8.16 Self-Diagnostic Function

Table 8-29 How to Use Self-Diagnostic Function

Group	Code	Parameter Name	Setting
Function 2	H60	[Self-Diagnostic Selection]	-
Terminal Group	t1	[Digital Input1 - P1]	-
	t2	[Digital Input2 - P2]	20
	t3	[Digital Input3 - P3]	20
	t4	[Digital Input4 - P4]	20
	t5	[Digital Input5 - P5]	21
	t6	[Digital Input6 - P6]	20
	t7	[Digital Input7 - P7]	20
	t8	[Digital Input8 - P8]	20
Select Self-Diagnostic Function in H60, Function group 2. Define one terminal among P1 to P8 terminals for this function. To define P8 for this function, set t8 to “20”.			

Perform Self-diagnostic function after input/output wiring of the inverter is finished.
This allows the user to safely check for the IGBT fault, output phase open and short, and Ground fault without disconnecting the inverter wiring.

There are 4 options:

F60	Self-Diagnostic function	0	Self-Diagnostic disabled
		1	IGBT fault and Ground fault. Ground fault of U phase in 2.2KW to 4.0KW inverters and ground fault of V phase in other rating inverters may not be detected when selecting “1”. Select 3 to make sure to detect all phase of U, V, W
		2	Output phase short & open circuit and Ground fault
		3	Ground fault (IGBT fault, Output phase short and open circuit)

F60 value Note: Selecting the higher number performs all functions within lower numbers, 3 performs all.

Once H60 is set to a specific value from 1 to 3 and the terminal defined for this function among P1 to P8 terminals is turned ON, the corresponding function is conducted, displaying “dIAG”.

To stop this function, press STOP/RESET key on the keypad, turn the defined terminal OFF or turn the EST terminal ON.

The fault types during Self Diagnostics are:

No.	Display	Fault Type	Diagnosis
1	UPHF	Switch above IGBT's U phase fault	Contact Baldor District Office.
2	UPLF	Switch below IGBT's U phase fault	
3	vPHF	Switch above IGBT's V phase fault	
4	vPLF	Switch below IGBT's V phase fault	
5	WPHF	Switch above IGBT's W phase fault	
6	WPLF	Switch below IGBT's U phase fault	
7	UWSF	Output short between U and W	Check for a short in inverter output terminal, motor connection terminal or the proper motor connection.
8	vUSF	Output short between U and V	
9	WvSF	Output short between V and W	
10	UPGF	Ground fault at U phase	Check for ground fault occurring at inverter output cable or motor or motor insulation damage.
11	vPGF	Ground fault at V phase	
12	WPGF	Ground fault at W phase	
13	UPOF	Output open at U phase	Check for proper connection of the motor to the inverter output or proper motor connection.
14	vPOF	Output open at V phase	
15	WPOF	Output open at W phase	

8.17 Parameter Read/Write

Table 8-30 Parameter Read/Write

Group	Code	Parameter Name	Setting	Unit
Function 2 (High)	H91	[Parameter Read]	1	
	H92	[Parameter Write] **Note:** Parameter write (H92) clears parameter values and parameter values in remote keypad are copied to inverter.	1	
Used to read/write Inverter Parameters using remote keypad.				

8.17.1 Parameter Read

Step 1. Move to H91 code.
Step 2. Press Enter/Prog key once. 0 will be displayed.
Step 3. Press Up () key once. Rd will be displayed.
Step 4. Press Enter/Prog key twice. Rd will be displayed.
Step 5. H91 is displayed when Parameter read is finished.

8.17.2 Parameter Write

Step 1. Move to H92 code. H92 will be displayed.
Step 2. Press Enter/Prog key once. 0 will be displayed.
Step 3. Press Up () key once. Wr will be displayed.
Step 4. Press Enter/Prog key twice. Wr will be displayed.
Step 5. H91 is displayed when Parameter read is finished.

8.18 Parameter Initialization / Lock

8.18.1 Parameter Initialization

Table 8-31 Parameter Initialization

Group	Code	Parameter Name	Setting	Unit
Function 2 (High)	H93	[Parameter Initialization]	0 -	
			1 - Initialize All Groups	
			2 - Initialize Drive Group	
			3 - Initialize F 1 Group	
			4 - Initialize F 2 Group	
			5 - Initialize I/O group	
Select the group to be initialized and perform it in H93 code.				

Press Enter/Prog key after setting in H93. H93 will be displayed again after initialization is complete.

8.18.2 Password Registration

Table 8-32 Password Registration

Group	Code	Parameter Name	Setting	Unit
Function 2	H94	[Password Registration]	-	
	H95	[Parameter Lock]	-	
Register password for Parameter lock (H95). Password is Hex characters 0 to 9, A, B, C, D, E and F.				

Factory default password is 0. Enter/Prog any new password except 0.
Do not forget the registered password. It is needed to unlock parameters.

Registering the password for the first time.
Step 1. Move to H94 code. H94 will be displayed.
Step 2. Press Enter/Prog key twice. 0 will be displayed.
Step 3. Register password. (Ex: 123) 123 will be displayed.
Step 4. 123 will blink when Enter/Prog key is pressed. 123 will be displayed.
Step 5. Press Enter/Prog key. H94 will be displayed after the new password has been registered.

Changing password. (Current PW: 123 -> New PW: 456)
Step 1. Move to H94 code. H94 will be displayed.
Step 2. Press Enter/Prog key. 0 will be displayed.
Step 3. Enter any number (e.g.: 122). 122 will be displayed.
Step 4. Press the Enter/Prog key. 0 is displayed because wrong value was entered
Password cannot be changed in this status. 0 will be displayed.
Step 5. Enter the right password. 123 will be displayed.
Step 6. Press Enter/Prog key. 123 will be displayed.
Step 7. Enter the new password. (e.g. 456). 456 will be displayed.
Step 8. Press the Enter/Prog key. Then “456” will blink. 456 will be displayed.
Step 9. Press Enter/Prog key. H94 will be displayed.

8.18.3 Parameter Lock

Table 8-33 Parameter Lock

Group	Code	Parameter Name	Setting	Unit
Function 2	H94	[Password Registration]	-	
	H95	[Parameter Lock]	-	
This parameter is used to lock the user-set parameters using the password.				

Locking the user-set parameters.

Step 1. Move to H95 code. H95 will be displayed.
Step 2. Press Enter/Prog key. UL will be displayed.
Step 3. Parameter value can be changed in UL (Unlock) status. UL will be displayed.
Step 4. Press Enter/Prog key. 0 will be displayed.
Step 5. Enter the password created in H94 (e.g.: 123). 123 will be displayed.
Step 6. Press Enter/Prog key. L will be displayed.
Step 7. Parameter value cannot be changed in L (Lock) status. L will be displayed.
Step 8. Press Enter/Prog key. H95 will be displayed.

Unlocking the user-set parameter.

Step 1. Move to H95 code. H95 will be displayed.
Step 2. Press Enter/Prog key. L will be displayed.
Step 3. Parameter value cannot be changed in L(Lock) status. L will be displayed.
Step 4. Press Enter/Prog key. 0 will be displayed.
Step 5. Enter the password created in H94 (e.g.: 123). 123 will be displayed.
Step 6. Press Enter/Prog key. UL will be displayed.
Step 7. Parameter value can be changed in UL (Unlock) status. While UL is displayed, press Enter/Prog key. H95 will be displayed.

8.19 Digital Output Terminal (MO) and Relay (3AC)

Table 8-34 Digital Output Terminal (MO) and Relay (3AC)

Group	Code	Parameter Name	Setting				Unit
Terminal	t32	[Digital output terminal selection]	0 FDT-1				
	t33	[Relay Output Selection]	1 FDT-2				
			2 FDT-3				
			3 FDT-4				
			4 FDT-5				
			5 Overload [OLt]				
			6 Inverter Overload [IOLt]				
			7 Motor Stall [STALL]				
			8 Over Voltage Trip [OV]				
			9 Low Voltage Trip [LV]				
			10 Inverter Ooverheat [OH]				
			11 Command Loss				
			12 During Run				
			13 During Stop				
			14 During Constant Run				
			15 During Speed Searching				
			16 Wait Time For Run Input				
			17 Fault Output				
			18 Cooling Fan Trip Alarm				
	t34	[Fault relay output]		Bit2 (3)	Bit1 (2)	Bit0 (1)	
			0	-	-	√	
			1	-	-	-	
			2	-	√	√	
			3	-	√	-	
			4	√	-	√	
			5	√	-	-	
			6	√	√	√	
			7	√	√	-	
Select the desired item to be output using MO terminal and relay (3A-C).							

(1) When low voltage trip occurs.
(2) When trip other than low voltage trip occurs.
(3) When setting H26 [Number of auto restart attempts].

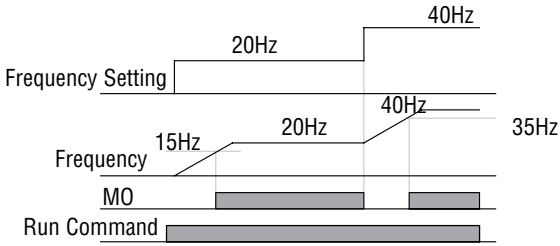
8.19.1 FDT-1

Verify the output frequency matches the user-setting frequency.
Active condition: Absolute value (preset frequency - output frequency) <= Frequency Detection Bandwidth/2

Table 8-35 FDT-1

Group	Code	Parameter Name	Setting	Unit
Terminal	t31	[Detected Frequency Bandwidth]	-	
Cannot be set greater than Max frequency (P36).				

Figure 8-13 FDT-1 When setting t31 to 10.0



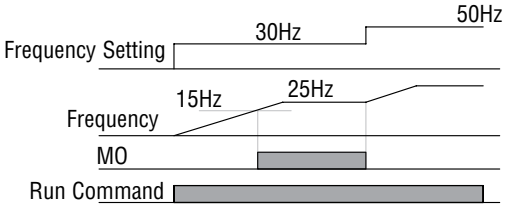
8.19.2 FDT-2

Activated when the preset frequency matches frequency detection level (t52) and FDT-1 condition is met.
Active condition: (Preset frequency = FDT level) & FDT-1

Table 8-36 FDT-2

Group	Code	Parameter Name	Setting	Unit
Terminal	t30	[Detected Frequency Level]	-	
	t31	[Detected Frequency Bandwidth]	-	
Cannot be set greater than Max frequency (P36).				

Figure 8-14 FDT-2 When setting t30 and t31 to 30.0 Hz and 10.0 Hz, respectively



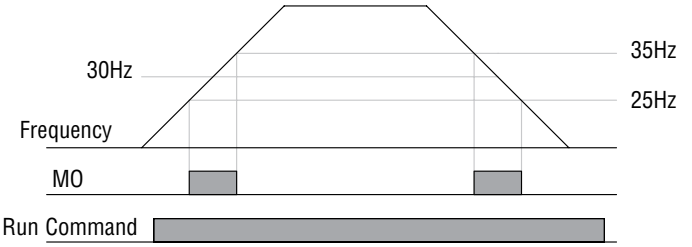
8.19.3 FDT-3

Activated when run frequency meets the following condition.
Active condition: Absolute value (FDT level - run frequency) <= FDT Bandwidth/2

Table 8-37 FDT-3

Group	Code	Parameter Name	Setting	Unit
Terminal	t30	[Detected Frequency Level]	-	
	t31	[Detected Frequency Bandwidth]	-	
Cannot be set greater than Max frequency (P36).				

Figure 8-15 FDT-3 When setting t30 and t31 to 30.0Hz and10.0 Hz, respectively



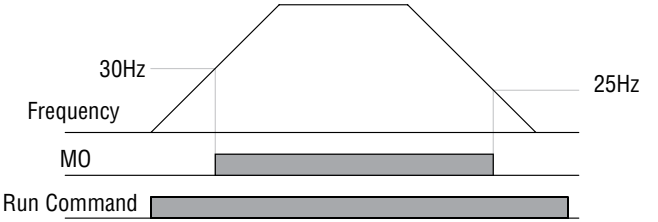
8.19.4 FDT-4

Activated when run frequency meets the following condition.
Active condition: Accel time: Run Frequency >= FDT Level
Decel time: Run Frequency > (FDT Level - FDT Bandwidth/2)

Table 8-38 FDT-4

Group	Code	Parameter Name	Setting	Unit
Terminal	t30	[Detected Frequency Level]	-	
	t31	[Detected Frequency Bandwidth]	-	
Cannot be set greater than Max frequency (P36).				

Figure 8-16 FDT-4 When setting t30 and t31 to 30.0Hz and 10.0 Hz, respectively



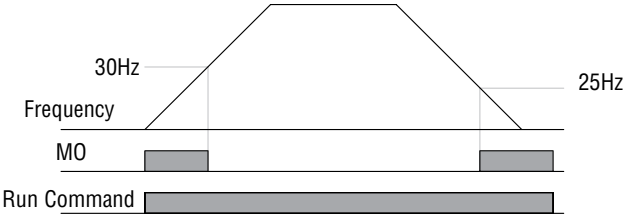
8.19.5 FDT-5

Activated as B contact contrast to FDT-4.
Active condition: Accel time: Run Frequency >= FDT Level
Decel time: Run Frequency > (FDT Level - FDT Bandwidth/2)

Table 8-39 FDT-5

Group	Code	Parameter Name	Setting	Unit
Terminal	t30	[Detected Frequency Level]	-	
	t31	[Detected Frequency Bandwidth]	-	
Cannot be set greater than Max frequency (P36).				

Figure 8-17 FDT-5 When setting t30 and t31 to 30.0Hz and 10.0 Hz, respectively



8.19.6 Over Voltage Trip (Ovt)

Activated when over voltage trip occurs due to DC link voltage exceeded 460VDC for 230V class and 820VDC for 460V class.

8.19.7 Low Voltage Trip (Lvt)

Activated when low voltage trip occurs due to DC link voltage under 180VDC for 200V class and 360VDC for 400V class.

8.19.8 Inverter Heatsink Overheat (OHt)

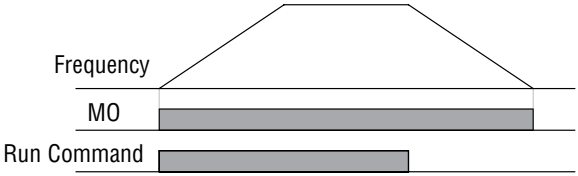
Activated when the heatsink is overheated.

8.19.9 Command Loss

Activated when Analog (V1,I) and RS485 communication commands are lost.

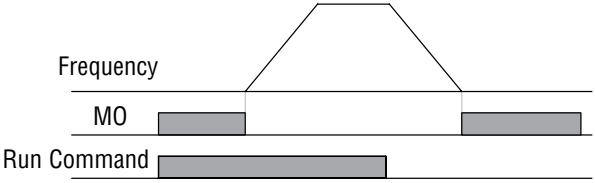
8.19.10 During Operation

Activated when run command is input and inverter outputs its voltage.



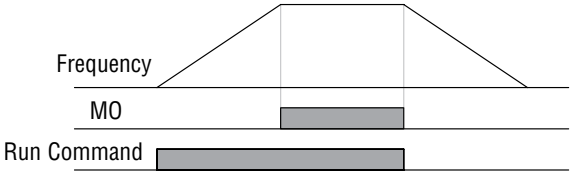
8.19.11 During Stop

Activated during stop without active command.



8.19.12 During Constant Run

Activated during constant speed operation.



8.19.13 Wait Time for Run Signal Input

This function becomes active during normal operation and that the inverter waits for active run command from external sequence.

8.19.14 Fault Output

The parameter set in t34 is activated.
For example, if setting t33, t34 to 17 and 2, respectively, Digital output relay will become active when trip other than “Low voltage trip” occurred.

8.19.15 Cooling Fan Trip Alarm

Used to output alarm signal when H78 is set to 0 (constant operation at cooling fan trip).

8.20 Communication Group Parameters

C-Group parameters are only available when a communication card is installed. For a complete description of the parameters see the appropriate communication card manual.

Table 8-40 Communication Group Parameters

Parameter No.	Parameter Name	Default	Min	Max	Unit	Message	Adj. During run	R/W
C0	Jump Code	1	0	99			0	-
C1	FieldBus Option Name	-	dnEt	PnEt		dnEt : DeviceNet EnEt : Modbus-TCP (Reserved) PnEt : Profibus-DP (Reserved)	-	R
C2	Software Version	-	-	-			-	R
C3	FieldBus ID	1	0	63			0	R/W
C4	FieldBus Baudrate	125k	125k	500k	bps	125kbps 250kbps 500kbps	0	R/W
C5	FieldBus LED Status						X	X
C6	In Instance	70	70	144		70, 71, 110, 111, 141-144	X	R/W
C7	Parameter Status Number	0	0	4			X	R
C8	Parameter Status 1	0x0000	0x0000	0xFFFF			0	R/W
C9	Parameter Status 2	0x0000	0x0000	0xFFFF			0	R/W
C10	Parameter Status 3	0x0000	0x0000	0xFFFF			0	R/W
C11	Parameter Status 4	0x0000	0x0000	0xFFFF			0	R/W
C16	Out Instance	20	20	124		20, 21, 100, 101, 121-124	X	R/W
C17	Parameter Control Number	0	0	4			X	R
C18	Parameter Control 1	0x0000	0x0000	0xFFFF			X	R/W
C19	Parameter Control 2	0x0000	0x0000	0xFFFF			X	R/W

Table 8-41 Communication Group Parameters Continued

Parameter No.	Parameter Name	Default	Min	Max	Unit	Message	Adj. During run	R/W
C20	Parameter Control	3	0x0000	0x0000	0xFFFF			X
C21	Parameter Control	4	0x0000	0x0000	0xFFFF			X
C26	Receive Frame Number		0	-	-			-
C27	Error Frame Number	0	-	-			-	R
C28	Nak Frame Number	0	-	-			-	R
C36	Communication Update	0	0	1		0 : No, 1 : Yes	X	R

Chapter 9

Troubleshooting

The VS1MD constantly monitors its status and provides the following ways to determine the status of the drive and to troubleshoot problems that may occur:

- LEDs on the drive
- Fault Codes displayed on seven segment display
- Drive monitor and status parameters
- Entries in the fault queue

9.1 Verify DC Bus Capacitors are Discharged

WARNING: **Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Dangerous voltages are present inside the equipment. Electrical shock can cause serious or fatal injury.**

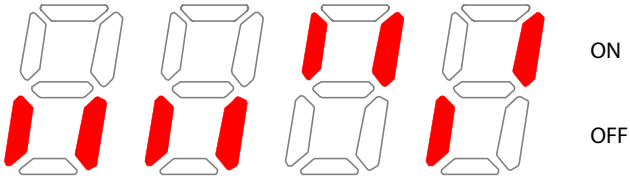
Step 1. Turn off and lock out input power. Wait 10 minutes after the display goes blank.
Step 2. Remove the drive cover.
Step 3. Verify that there is no voltage at the drive input power terminals.
Step 4. Once the drive has been serviced, install the drive cover.
Step 5. Apply input power to the drive.

9.2 Determine Drive Status Using the STP/FLT LED

The STP/FLT LED can be used to determine at a quick glance the status of the drive. If the drive is stopped, but not faulted, this LED will be illuminated solid. If the drive is running, this LED will be off. If this LED is flashing, then this indicates that the drive is faulted thus requiring attention.

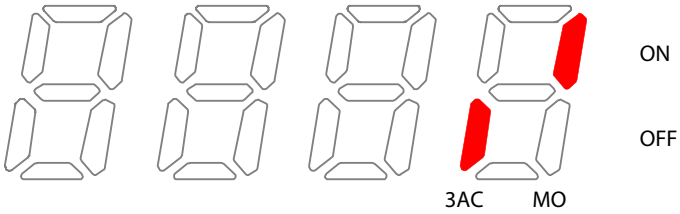
The Display Group has multiple parameters that can be utilized for monitoring the status of the drive and are useful for diagnosing certain situations. If the drive is being operated from the terminal strip, it is useful to monitor the status of the digital inputs to determine operational problems. The digital input status can be monitored by displaying parameter d7. Figure 9-1 describes the details of understanding the status of each of the digital inputs (labeled P1 - P8 on the control board terminal strip). In this example, P1, P3, and P4 are ON and P2, P5, P6, P7, and P8 are OFF.

Figure 9-1 Digital Inputs Example



If the application is using digital outputs to reflect the internal status of the drive, these can be monitored using parameter d8. The below describes the details of understanding the status of each of the digital outputs (labeled MO for the open collector output and 3A/3B/3C for the relay output on the control board terminal strip).
Figure 9-2, the Digital output MO is ON and the Relay Output is OFF (note that the indication for the Relay is an indication of whether or not the relay coil is energized).

Figure 9-2 Digital Outputs Example



9.3 Reviewing Fault Status of the Drive

As noted in Chapter 6, the Display Group has an entry that designates if there is an active fault and will display the fault code associated with that fault. The fault codes are described later in this chapter. While displaying the fault code within the Display Group, you can press the enter key to display the frequency the drive was running at when the fault occurred. By pressing the up arrow one time, you can display the current the drive detected when the fault occurred. By pressing the up arrow again, you will display the drive status when the fault occurred.

Function Group 2 (H parameters) also contains the current fault along with a history of the previous 4 faults. These faults are located at parameters H1, H2, H3, H4, and H5. As with the fault memory in the Display Group, you can subsequently display the frequency, current, and status for each of these faults using the same procedure outlined in Chapter 6.

9.4 Fault Codes

Fault codes indicate conditions within the drive that require immediate attention. The drive responds to a fault by initiating a coast-to-stop sequence and turning off motor power.
The integral keypad provides visual notification of a fault condition by displaying the following:

- Fault code on the display. (See table 9.1 for the fault code descriptions.)
- Flashing STP/FLT LED

9.4.1 Manually Clearing Faults

Step 1. Note the code of the fault condition on the display.
Step 2. Address the condition that caused the fault. Refer to Table 9-1 for a description of the fault and corrective actions. The cause must be corrected before the fault can be cleared.
Step 3. After corrective action has been taken, clear the fault and reset the drive.

9.4.2 Automatically Clearing Faults (Auto Restart Feature)

The Auto Restart feature provides the ability for the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. This allows remote operation. This feature can only be used for faults that are auto-resettable.
When this type of fault occurs, and H26 (Auto Restart) is set to a value greater than 0, a user-configurable timer, H27 (Retry Delay) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will be restarted.

9.5 Overload Protection

IOLT : IOLT (inverter Overload Trip) protection is activated at 150% of the inverter rated current for 1 minute and greater.

OLT : OLT is selected when F56 is set to 1 and activated at 200% of F57 [Motor rated current] for 60 sec in F58. This can be programmable.

Table 9-1 Fault Descriptions and Corrective Actions

Fault Code	Fault	Descriptions	Cause	Remedy
	Overcurrent	The drive disables when the output current is detected at a level higher than the inverter rated current.	Accel/Decel time is too short. Load is too heavy. Inverter enabled when the motor is rotating. Output short circuit or ground fault has occurred. Mechanical brake operating incorrectly.	Increase the Accel/Decel time. Use the inverter with more hp. Resume operation after stopping the motor or use H22. Check output wiring. Check the mechanical brake.
	Ground Fault Current	The drive disables when a ground fault occurs and the ground fault current is greater than the internal setting value of the inverter.	Ground fault has occurred in the output wiring of the drive. The insulation of the motor is damaged.	Check the wiring between the drive and the motor. Replace the motor.
	Inverter Overload	The drive disables its output when the output current of the inverter is greater than the rated level.	Load is greater than the drive rating.	Upgrade to larger motor and drive or reduce the load.
	Overload Trip	The drive disables if the output current of the inverter is at 150% of the inverter rated current for more than the current limit time (1 min).	Torque boost scale is set too large.	Reduce torque boost scale.
	Inverter Overheat	The drive disables if the heat sink overheats due to a damaged cooling fan or a blockage in the cooling fan by detecting the temperature of the heat sink.	Cooling system has problems. Cooling fan has failed. Ambient temperature is too high. Clogged ventilating slot.	Check for foreign substances clogged in the heat sink. Replace the cooling fan. Reduce ambient temperature. Clean the ventilation.

Table 9-1 Fault Descriptions and Corrective Actions Cont.

Fault Code	Fault	Descriptions	Cause	Remedy
POt	Output Phase Loss	The drive disables its output when one or more of the output (U, V, W) phases is open. The drive detects the output current to check the output phase loss.	Faulty contact in output contactor. Faulty output wiring.	Replace or repair output contactor. Check output wiring.
Out	Over Voltage	The drive disables its output if the DC bus voltage increases above the bus overvoltage threshold. This fault can also occur due to a surge voltage generated at the input terminals.	Decel time is too short for the inertia of the load. Regenerative load is connected to the drive. Line voltage is too high.	Increase the Decel time. Use Dynamic Brake Unit. Check to see if line voltage exceeds the rating.
Lut	Low Voltage	The drive disables its output if the DC bus voltage is less than the undervoltage threshold because insufficient torque or overheating of the motor can occur when the input voltage of the drive is too low.	Line voltage is low. Load larger than line capacity is connected to line (ex: welding machine, motor with high starting current connected to the commercial line). Faulty contactor on the input of the inverter.	Check to see if line voltage is below the rating. Check the incoming AC line. Adjust the line capacity corresponding to the load. Change contactor.
EtH	Electronic Thermal	The internal electronic thermal of the drive determines the motor heat. If the motor is overloaded the inverter disables the output. The drive cannot protect the motor when controlling a motor having more than 4 poles or multiple motors.	Motor has overheated. Load is greater than inverter rating. ETH level is set too low.	Reduce load and/ or duty cycle. Use drive with higher hp rating. Adjust ETH level.
COL	Input Phase Loss	Drive output is disabled when one of the input phases (R, S, T) is open.	Open protective device or wire.	Verify proper voltage at R,S and T inputs. Correct problem.

Table 9-1 Fault Descriptions and Corrective Actions Cont.

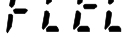
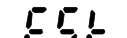
Fault Code	Fault	Descriptions	Cause	Remedy
	Self-Diagnostic Malfunction	Displayed when IGBT damage, output phase short, output phase ground fault or output phase open occurs.	Damaged input device. Miswired input device.	Replace input device. Verify proper connections of input device.
	Parameter Save Error	Displayed when user-modified parameters fail to be stored into memory.		
	Inverter Hardware Fault	Displayed when an error occurs in the control circuitry of the drive.		
	Communication Error	Displayed when the drive cannot communicate with the keypad.		
	Remote Keypad Communication Error	Displayed when drive and remote keypad do not communicate with each other. This fault does not stop Inverter operation.		
	Keypad Error	Displayed after drive resets keypad upon a keypad error and the error remains for a predetermined time.		
	Cooling Fan Fault	Displayed when a fault condition occurs in the drive cooling fan.	Cooling fan has failed. Clogged ventilating slot.	Replace cooling fan. Clean ventilation.
	Instant Cut Off	Used for the immediate stop of the drive. The inverter instantly disables the output when the EST terminal is actuated.		
	External Fault A Contact Input	When Digital input terminal (t1-t8) is set to 18 {External fault signal input: A (Normal Open Contact)}, the inverter disables its output.		

Table 9-1 Fault Descriptions and Corrective Actions Cont.

Fault Code	Fault	Descriptions	Cause	Remedy
EtB	External Fault B Contact Input	When Digital input terminal (t1-t8) is set to 19 {External fault signal input: B (Normally Closed Contact)}, the drive disables its output.		
- - 1	Operating Method When the Frequency Command is Lost	When drive operation is set via an Analog input (0-10V or 0-20mA input) or option (RS485) and the signal is lost, the drive responds according to the method set in t62 (Operating method when the frequency reference is lost).		
nTC	NTC Open	When NTC connection is lost, output is disabled.		
EEP	Parameter Save Error			Contact Baldor District Office for assistance.
HW	Hardware Fault			

Appendix A

Technical Specifications

All specifications are subject to change without notice.

Table A-1 VS1MD Specifications

Input Ratings	Voltage	230	460
	Voltage Range	170-253	323-528
	Phase	Three Phase (single phase with derating)	
	Frequency	50/60Hz ±5%	
	Impedance	1% minimum from mains connection	

Output Ratings	Horsepower	1/2-10 HP @ 230VAC, 3PH 1/2-10 HP @ 460VAC, 3PH
	Overload Capacity	150% for 1 minute; 200% for 12 seconds.
	Frequency	0-400Hz
	Voltage	0 to maximum input voltage (RMS)

Protective Features	Trip	Missing control power, over current, over voltage, under voltage, over temperature (motor or control), output shorted or grounded, motor overload
	Stall Prevention	Over voltage suppression, over current suppression
	External Output	LED trip condition indicators, 4 assignable logic outputs, 2 assignable analog outputs
	Short Circuit	Phase to phase, phase to ground
	Electronic Motor Overload	Meets UL508C (I2T)

Environmental Conditions	Temperature	-10°C to 50°C Derate 3% per degree C above 50°C to 55°C maximum ambient temperature
	Cooling	0.5hp Natural; 1-10hp Forced air
	Enclosure	IP20, NEMA 1 (optional)
	Altitude	Sea level to 3300 Feet (1000 Meters) Derate 2% per 1000 Feet (303 Meters) above 3300 Feet
	Humidity	10 to 90% RH Non-Condensing
	Shock	1G
	Vibration	0.5G at 10Hz to 60Hz
	Storage Temperature	-20°C to +65°C
	Duty Cycle	1.0

Table A-1 VS1MD Specifications Continued

Keypad Display	Display	Four digit LED
	Keys	14 key membrane with tactile response
	Functions	Output status monitoring Digital speed control Parameter setting and display Diagnostic and Fault log display Motor run and jog Local/Remote toggle
	LED Indicators	Forward run command Reverse run command Stop command Jog active
	Remote Mount	200 feet (60.6m) maximum from control
	Trip	Separate message for each trip, last 5 trips retained in memory

Control Specifications	Control Method	V/Hz inverter, Sensorless vector
	PWM Frequency	Adjustable 1.0-15kHz
	Speed Setting	±10VDC, 0-10VDC, 0-20mA; digital (keypad)
	Accel/Decel	0-6000 seconds
	Velocity Loop Bandwidth	Adjustable to 180Hz (Control only)
	Current Loop Bandwidth	Adjustable to 1200Hz (Control only)
	Maximum Output Frequency	400Hz

Appendix B
Parameter Tables

B.1 Parameters Sorted by Parameter Number

Table B-1 Parameters Sorted by Parameter Number

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
C0	Tune	Jump Code	0-99	1	
C1	RO	FieldBus Option Name	dnEt, EnEt, PnEt	dnEt	
C2	RO	Software Version			
C3	Tune	FieldBus ID	0-63	1	
C4	Tune	FieldBus Baud Rate	125k-500kbps	125k	
C5	R/W	FieldBus LED Status			
C6	R/W	In Instance	70-144	70	
C7	R/W	Parameter Status Number	0-4	0	
C8	Tune	Parameter Status 1	0x0000 - 0xFFFF	0x0000	
C9	Tune	Parameter Status 2	0x0000 - 0xFFFF	0x0000	
C10	Tune	Parameter Status 3	0x0000 - 0xFFFF	0x0000	
C11	Tune	Parameter Status 4	0x0000 - 0xFFFF	0x0000	
C16	R/W	Out Instance	20-124	20	
C17	R/W	Parameter Control Number	0-4	0	
C18	R/W	Parameter Control 1	0x0000 - 0xFFFF	0x0000	
C19	R/W	Parameter Control 2	0x0000 - 0xFFFF	0x0000	
C20	R/W	Parameter Control 3	0x0000 - 0xFFFF	0x0000	
C21	R/W	Parameter Control 4	0x0000 - 0xFFFF	0x0000	
C26	RO	Receive Frame Number		0	
C27	RO	Error Frame Number		0	
C28	RO	Nak Frame Number		0	
C36	RW	Communication Update	0-1	0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
d0	RO	Frequency Command	0.00 to Frequency High Limit (P36) Hz	N/A	
d1	RO	Motor RPM	0 Motor RPM (based on P33 Motor Poles) RPM	N/A	
d2	RO	Output Current	0.0 to Motor Rated Current (P32) Amps	N/A	
d3	RO	Output Voltage	0.0 to Drive Rated Voltage VAC	N/A	
d4	RO	Output Power	0.00 to (Drive Rated Power x 2) kW	N/A	
d5	RO	Output Torque	0.00 to (Drive Rated Torque x 2) [kgf / M]	N/A	
d6	RO	DC Link Voltage	Based on Drive Rating VDC	N/A	
d7	RO	Input Terminal Status Display	N/A	N/A	
d8	RO	Output Terminal Status Display	N/A	N/A	
d9	RO	Software Version	1.0 to 99.9	N/A	
d10		PID Control Feedback Amount		N/A	
n0n	RO	Current Fault Display	N/A	N/A	
P0	Tune	Jump Code	30 - 99	30	
P30	R/W	Motor HP Select	0.5 = 0.5 HP 1 = 1 HP 2 = 2 HP 3 = 3 HP 5 = 5 HP 7.5 = 7.5 HP 10 = 10 HP 15 = 15 HP 20 = 20 HP 25 = 25 HP 30 = 30 HP	Calc	
P32	R/W	Motor Rated Current	0.5 - 50 Amps	Calc	
P33	R/W	Pole Number	2, 4, 6, 8, 10, 12	4	
P34	R/W	Base Frequency	30-400Hz	60.00	
P35	R/W	Frequency Low Limit	0-P36Hz	10.00	
P36	R/W	Frequency High Limit	0-400Hz	60.00	
P37	Tune	Frequency Command	0-400Hz	0.00	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
P38	R/W	Stop/Start Source	0 = Keypad 1 = Terminal Mode 1 2 = Terminal Mode 2 3 = RS485 Communication 4 = Communication Module	0	
P39	R/W	Stop Type	0 = Decelerate to Stop (Ramp) 1 = DC Brake to Stop 2 = Coast to Stop 3 = Power Braking	0	
P40	R/W	Frequency Setting Method	1 = Digital Keypad 2 = Analog V1 1: ± 10V 3 = Analog V1 2: 0 to +10 V 4 = Analog Terminal I: 0 - 20mA 5 = Analog Terminal V1 Mode 1 6 = Analog Terminal V1 Mode 2 7 = Analog RS485 8 = MOP Reference 9 = Communication Module	1	
P41	Tune	Accel Time	0-6,000Sec	5.0	
P42	Tune	Decel Time	0-6,000Sec	10.0	
P43	Tune	Preset Speed 1	0-400Hz	10.00	
P44	Tune	Preset Speed 2	0-400Hz	20.00	
P45	Tune	Preset Speed 3	0-400Hz	30.00	
P46	R/W	Drive Start/Stop Source 2	0 = Keypad 1 = Terminal Mode 1 2 = Terminal Mode 2 3 = RS485 Communication 4 = Communication Module	1	
P47	R/W	Frequency Setting Mode 2	1 = Digital Keypad 2 = Analog V1 1: ± 10V 3 = Analog V1 2: 0 to +10 V 4 = Analog Terminal I: 0 - 20mA 5 = Analog Terminal V1 Mode 1 6 = Analog Terminal V1 Mode 2 7 = Analog RS485 8 = Communication Module	1	
P48	Tune	PID Control Standard Value Setting	0-400Hz or 0.00 to 100%	0.00	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t0	Tune	Jump Code	0 - 99	1	
t1	Tune	Digital Input 1	0 = Forward Run Command 1 = Reverse Run Command 2 = Output Inhibit 3 = Fault Reset (RST) 4 = Jog Speed Select (2Wire only) 5 = Speed Select1 6 = Speed Select2 7 = Speed Select3 8 = Ramp Select1 9 = Ramp Select2 10 = Ramp Select3 11 = DC Brake during start 12 = 2nd Motor Select 13 = Timer Maintained 14 = Timer Momentary 15 = Frequency increase (UP) 16 = Frequency decrease (DOWN) 17 = 3Wire Stop 18 = External Trip: A Contact (EtA) 19 = External Trip: B Contact (EtB) 20 = Self-Diagnostic Function 21 = Exchange between PID and V/F operation 22 = Exchange between second source and drive 23 = Analog Hold 24 = Accel/Decel Disable 25 = Up/Down Save Freq. Initialization 26 = Jog Forward 27 = Jog Reverse 28 = Timer Reset	0	
t2	Tune	Digital Input 2		1	
t3	Tune	Digital Input 3		2	
t4	Tune	Digital Input 4		3	
t5	Tune	Digital Input 5		4	
t6	Tune	Digital Input 6		5	
t7	Tune	Digital Input 7		6	
t8	Tune	Digital Input 8		7	
t9	Tune	Filter Time Constant for Digital Inputs	1 - 15	4	
t10	Tune	Preset Speed 4	0-400Hz	30	
t11	Tune	Preset Speed 5	0-400Hz	25	
t12	Tune	Preset Speed 6	0-400Hz	20	
t13	Tune	Preset Speed 7	0-400Hz	15	
t14	Tune	Preset Speed Accel Time 1	0-6000Sec	3.0	
t15	Tune	Preset Speed Decel Time 1	0-6000Sec	3.0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t16	Tune	Preset Speed Accel Time 2	0-6000Sec	4.0	
t17	Tune	Preset Speed Decel Time 2	0-6000Sec	4.0	
t18	Tune	Preset Speed Accel Time 3	0-6000Sec	5.0	
t19	Tune	Preset Speed Decel Time 3	0-6000Sec	5.0	
t20	Tune	Preset Speed Accel Time 4	0-6000Sec	6.0	
t21	Tune	Preset Speed Decel Time 4	0-6000Sec	6.0	
t22	Tune	Preset Speed Accel Time 5	0-6000Sec	7.0	
t23	Tune	Preset Speed Decel Time 5	0-6000Sec	7.0	
t24	Tune	Preset Speed Accel Time 6	0-6000Sec	8.0	
t25	Tune	Preset Speed Decel Time 6	0-6000Sec	8.0	
t26	Tune	Preset Speed Accel Time 7	0-6000Sec	9.0	
t27	Tune	Preset Speed Decel Time 7	0-6000Sec	9.0	
t28	Tune	Analog Output Select	0 = Output Frequency 1 = Output Current 2 = Output Voltage 3 = DC Link Voltage	0	
t29	Tune	Analog Output Level Adjustment	10 - 200%	100	
t30	Tune	Frequency Detection Level	0-400Hz	30	
t31	Tune	Frequency Detection Bandwidth	0-400Hz	10	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t32	Tune	Digital Output (MO)	0 = FDT-1 1 = FDT-2 2 = FDT-3 3 = FDT-4 4 = FDT-5 5 = Overload (OLt) 6 = Inverter Overload (LoIT) 7 = Motor Stall 8 = Over Voltage Trip (OV) 9 = Low Voltage Trip (LV)	12	
t33	Tune	Relay Output (3A - 3C)	10 = Inverter Overheat (OH) 11 = Command Loss 12 = During Run 13 = During Stop 14 = During Constant Run 15 = During Speed Searching 16 = Wait Time for Run Signal Input 17 = Fault Output 18 = Cooling Fan Trip Alarm 19 = Brake Signal Select 20 = Timer Output	17	
t34	Tune	Fault Relay Output	0-7	2	
t35	Tune	Criteria for Analog Input Signal Loss	0 = Disabled 1 = Activated when less than half of set value 2 = Activated when less than set value	0	
t36	Tune	Analog Input (NV) Min Voltage	0 - 10V	0	
t37	Tune	Frequency Corresponding to t36	0 - 400Hz	0	
t38	Tune	Analog Input 0 to 10V (NV) Max Voltage	0 to 10V	10	
t39	Tune	Frequency Corresponding to t38	0 - 400Hz	60	
t40	Tune	Analog Input 0 to 10V (V1) Filter Time Constant	0 - 9999	10	
t41	Tune	Analog Input 0 to 10V (V1) Min Voltage	0 - 10V	0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t42	Tune	Frequency Corresponding to t41	0 - 400Hz	0	
t43	Tune	Analog Input 0-10V (V1) Max Voltage	0 - 10V	10	
t44	Tune	Frequency Corresponding to t43	0-400Hz	60	
t45	Tune	Analog Input 0-20mA (I) Filter Time Constant	1-9999	10	
t46	Tune	Analog Input 0-20mA (I) Min Current	0-20mA	4	
t47	Tune	Frequency Corresponding to t46	0-400Hz	0	
t48	Tune	Analog Input 0-20mA (I) Max Current	0-20mA	20	
t49	Tune	Frequency Corresponding to t47	0-400Hz	60	
t50	R/W	Digital Output (MO) On Delay	0 to 3,600Sec	0	
t51	R/W	Relay Output (3A - 3C) On Delay	0 to 3,600Sec	0	
t52	R/W	Digital Output (MO) Off Delay	0 to 3,600Sec	0	
t53	R/W	Relay Output (3A - 3C) Off Delay	0 to 3,600Sec	0	
t54	R/W	Timer Value	0 to 3,600Sec	5	
t57	Tune	Keypad Error Output	0 = Not used 1 = Signal output to MO 2 = Signal output to 3A, 3B contacts 3 = Signal output to MO, 3A, 3B	0	
t59	R/W	Communication Protocol Select	0 = Modbus RTU 1 = CI485	0	
t60	Tune	Inverter Number	1-250	1	
t61	Tune	Baud Rate	0 = 1200 bps 1 = 2400 bps 2 = 4800 bps 3 = 9600 bps 4 = 19200 bps	3	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t62	Tune	Frequency Loss Mode	0 = Continue operation at last frequency command 1 = Coast to Stop 2 = Decelerate to stop	0	
t63	Tune	Frequency Loss Wait Time	0.1-120Sec	1.0	
t64	Tune	Communication Time Setting	2-100 ms	5	
t65	Tune	Parity/Stop Bit Setting	0 = Parity: None, Stop Bit: 1 1 = Parity: None, Stop Bit: 2 2 = Parity: Even, Stop Bit: 1 3 = Parity: Odd, Stop Bit: 1	0	
t66	Tune	Read Address Register 1	0-42239	0005	
t67	Tune	Read Address Register 2	0-42239	0006	
t68	Tune	Read Address Register 3	0-42239	0007	
t69	Tune	Read Address Register 4	0-42239	0008	
t70	Tune	Read Address Register 5	0-42239	0009	
t71	Tune	Read Address Register 6	0-42239	000A	
t72	Tune	Read Address Register 7	0-42239	000B	
t73	Tune	Read Address Register 8	0-42239	000C	
t74	Tune	Write Address Register 1	0-42239	0005	
t75	Tune	Write Address Register 2	0-42239	0006	
t76	Tune	Write Address Register 3	0-42239	0007	
t77	Tune	Write Address Register 4	0-42239	0008	
t78	Tune	Write Address Register 5	0-42239	0005	
t79	Tune	Write Address Register 6	0-42239	0006	
t80	Tune	Write Address Register 7	0-42239	0007	
t81	Tune	Write Address Register 8	0-42239	0008	
t82	Tune	Brake Open Current	0-180 Amps	50.0	
t83	R/W	Brake Open Delay Time	0-10Sec	1.00	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t84	R/W	Brake Open FX Frequency	0-400Hz	1.00	
t85	R/W	Brake Open RX Frequency	0-400Hz	1.00	
t86	R/W	Brake Close Delay Time	0-10Sec	1.00	
t87	R/W	Brake Close Frequency	0-400Hz	2.00	
F0	Tune	Jump Code	0-99	1	
F1	R/W	Forward/Reverse Run Disable	0 = Forward and Reverse Run Enable 1 = Forward Run Disable 2 = Reverse Run Disable	0	
F2	R/W	Accel Pattern	0 = Linear 1 = S-Curve	0	
F3	R/W	Decel Pattern	0 = Linear 1 = S-Curve	0	
F8	R/W	DC Brake Start Frequency	0.1-60Hz	5.00	
F9	R/W	DC Brake Wait Time	0-60Sec	0.1	
F10	R/W	DC Brake Voltage	0-200%	50	
F11	R/W	DC Brake Time	0-60Sec	1.0	
F12	R/W	DC Brake Start Voltage	0-200%	50	
F13	R/W	DC Brake Start Time	0-60Sec	0	
F14	R/W	Time for Magnetizing a Motor	0-60Sec	0.1	
F20	Tune	Jog Frequency	0-400Hz	10.00	
F27	R/W	Torque Boost Select	0 = Manual Torque Boost 1 = Auto Torque Boost	0	
F28	R/W	Torque Boost in Forward Direction	0-15%	2	
F29	R/W	Torque Boost in Reverse Direction	0-15%	2	
F30	R/W	V/F Pattern	0 = Linear 1 = Square 2 = User V/F	0	
F31	R/W	User V/F Frequency 1	0-400Hz	15	
F32	R/W	User V/F Voltage 1	0-100%	25	
F33	R/W	User V/F Frequency 2	0-400Hz	30	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
F34	R/W	User V/F Voltage 2	0-100%	50	
F35	R/W	User V/F Frequency 3	0-400Hz	45	
F36	R/W	User V/F Voltage 3	0-100%	75	
F37	R/W	User V/F Frequency 4	0-400Hz	60	
F38	R/W	User V/F Voltage 4	0-100%	100	
F39	R/W	Output Voltage Adjustment	40-110%	100	
F40	Tune	Energy Savings Level	0-30%	0	
F50	Tune	Electronic Thermal Select	0 = No 1 = Yes	0	
F51	Tune	Electronic Thermal Level for 1 Minute	F52-200%	150	
F52	Tune	Electronic Thermal Level Continuous	50-F51%	100	
F53	Tune	Motor Cooling Method	0 = Standard Motor 1 = Variable Speed Motor	0	
F54	Tune	Overload Warning Level	30-150%	150	
F55	Tune	Overload Warning Time	0-30Sec	10	
F56	Tune	Overload Trip Enable	0 = No 1 = Yes	1	
F57	Tune	Overload Trip Level	30-200%	180	
F58	Tune	Overload Trip Time	0-60Sec	60	
F59	R/W	Stall Prevention Select	0-7	0	
F60	R/W	Stall Prevention Level	30-200%	150	
F61	R/W	Stall Prevention During Deceleration	0 = No 1 = Yes	0	
F63	R/W	Save Up/Down Frequency	0 = No 1 = Yes	0	
F64	Tune	Saved Up/Down Frequency	0-400Hz	0.00	
F65	R/W	MOP Mode Select	0 = Reference changed between P35 and P36 1 = Speed change after edge input 2 = Combination of 0 and 1	0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
F66	R/W	MOP Step Frequency	0-400Hz	0.00	
F67	R/W	Start Frequency	0.10-10.00Hz	0.5	
F70	R/W	Draw Control Select	0 = No Draw Control 1 = V1 (0-10V) Input 2 = I (0-20mA) Input 3 = V1 (-10-10V) Input	0	
F71	Tune	Draw Control Rate	0-100%	0.0	
F72	R/W	Sleep Mode Boost Enable	0 = Boost Disable 1 = Boost Enable	0	
F73	R/W	Sleep Mode Boost Time	0.0 - 120.0 sec	10	
F74	Tune	Sleep Mode Boost Frequency	0 - Max. Frequency (P36)	30	
H0	Tune	Jump Code	0-99	1	
H1	RO	Last Fault 1	N/A	nOn	
H2	RO	Last Fault 2	N/A	nOn	
H3	RO	Last Fault 3	N/A	nOn	
H4	RO	Last Fault 4	N/A	nOn	
H5	RO	Last Fault 5	N/A	nOn	
H6	Tune	Reset Fault History	0 = No 1 = Yes		
H7	R/W	Dwell Frequency	0.00 - 400 Hz	5.00	
H8	R/W	Dwell Time	0-10Sec	0.0	
H10	R/W	Skip Frequency Enable	0 = No 1 = Yes	0	
H11	R/W	Skip Frequency Low Limit 1	0 - H12 Hz	10	
H12	R/W	Skip Frequency High Limit 1	H11 - 400 Hz	15	
H13	R/W	Skip Frequency Low Limit 2	0 - H14 Hz	20	
H14	R/W	Skip Frequency High Limit 2	H13 - 400 Hz	25	
H15	R/W	Skip Frequency Low Limit 3	0 - H16 Hz	30	
H16	R/W	Skip Frequency High Limit 3	H15 - 400 Hz	35	
H17	R/W	S-Curve Accel/ Decel Start Side	1 - 100%	40	
H18	R/W	S-Curve Accel/ Decel End Side	1 - 100%	40	
H19	Tune	Phase Loss Protection	0 = Not Used 1 = Output phase loss protection 2 = Input phase loss protection 3 = Input/output phase loss protection	0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H20	Tune	Power On Start	0 = No 1 = Yes	0	
H21	Tune	Auto Restart	0 = No 1 = Yes	0	
H22	R/W	Speed Search Select	0-15	0	
H23	Tune	Speed Search Current Level	80-200%	100	
H24	Tune	Speed Search P Gain	0-9999	100	
H25	Tune	Speed Search I Gain	0-9999	200	
H26	Tune	Auto Restart Attempts	0-10	0	
H27	Tune	Auto Restart Time	0-60Sec	1.0	
H32	R/W	Slip Frequency	0-10Hz	1.67	
H34	R/W	No Load Motor Current	0.1-20A	Calc	
H36	R/W	Motor Efficiency	50-100%		
H37	R/W	Load Inertia Rate	0 = Load inertia rate < 10 times motor inertia 1 = Load inertia rate ≈ 10 times motor inertia 2 = Load inertia rate > 10 times motor inertia	0	
H39	Tune	Carrier Frequency Select	2-15kHz	3.0	
H40	R/W	Control Mode Select	0 = Volts/Frequency Control 1 = Slip Compensation Control 2 = Sensorless Vector Control	0	
H41	R/W	Auto-Tuning	0-1	0	
H42	R/W	Stator Resistance (Rs)	0-28 Ohms	Calc	
H44	R/W	Leakage Inductance (Lσ)	0-300.0 mH	Calc	
H45	Tune	Sensorless P Gain	0-32767	1000	
H46	Tune	Sensorless I Gain	0-32767	100	
H47	R/W	Sensorless Torque Limit	100-220%	180	
H48	R/W	PWM Mode Select	0 = Normal PWM 1 = 2 Phase PWM	0	
H49	R/W	PID Control Select	0 = No 1 = Yes	0	
H50	R/W	PID Feedback Selection	0 =Terminal I Input (0-20 mA) 1 =Terminal V1 Input (0-10V)	0	
H51	Tune	P Gain for PID	0-999.9%	300.0	
H52	Tune	I Gain for PID	0.1-32.0Sec	1.0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H53	Tune	D Gain for PID	0-30.0Sec	0.0	
H54	R/W	PID Control Mode	0 = Normal PID Control 1 = Process PID Control	0	
H55	Tune	PID Output Frequency High Limit	H56 - 400 Hz	60.00	
H56	Tune	PID Output Frequency Low Limit	P35 Min, H55 Max	0.50	
H57	R/W	PID Reference Select	0 = Keypad setting 1 1 = Keypad setting 2 2 = V1 terminal 0-10V 3 = I terminal 0-20mA 4 = RS485 Communications	0	
H58	R/W	PID Units	0-1 (Hz or %)	0	
H60	R/W	Self Diagnostics Select	0 = Self-diagnostic disabled 1 = IGBT fault/ground fault 2 = Output phase short & open/ground fault 3 = Ground Fault	0	
H61	R/W	Sleep Delay Time	0-2000Sec	60	
H62	Tune	Sleep Frequency	0-400Hz	0	
H63	Tune	Wake-Up Level	0-100%	35	
H64	R/W	KEB Drive Select	0 = No 1 = Yes	0	
H65	R/W	KEB Action Start Level	110-140%	125	
H66	R/W	KEB Action Stop Level	110-145%	130	
H67	R/W	KEB Action Gain	1-20000	1000	
H70	R/W	Frequency Reference for Accel/Decel	0 - Based on P36 – Frequency High Limit 1 - Based on Delta Frequency	0	
H71	Tune	Accel/Decel Time Scale	0 = Setting Unit: 0.01 sec Range: 0.01- 600.00 1 = Setting Unit: 0.1 sec Range: 0.1- 6000.0 2 = Setting Unit: 1 sec Range: 1- 60000	1	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H72	Tune	Power-On Display	0 = Frequency Command 1 = Motor RPM 2 = Output Current 3 = Output Voltage 4 = Output Power 5 = Output Torque 6 = DC Link Voltage 7 = Digital Input Status 8 = Digital Output Status 9 = Software Version	0	
H74	Tune	Gain for Motor RPM Display	1 - 1000%	100	
H75	Tune	DB Resistor select	0 = Unlimited 1 = DB limited by H76	1	
H76	Tune	DB Resistor Operating Rate	0-30%	10	
H77	Tune	Cooling Fan Control	0 = Always ON 1 = Fan operates when temp above limit	0	
H78	Tune	Operating method when cooling fan fails	0 = Continuous 1 = Stop when fan fails	0	
H81	Tune	Accel Time	0-6000 Sec	1.0	
H82	Tune	Decel Time	0-6000 Sec	5.0	
H83	R/W	Base Freq	30-400Hz	60.0	
H84	R/W	V/F Pattern	0 = Linear 1 = Square 2 = User V/F	0	
H85	R/W	FX Torque Boost	0 - 15%	5	
H86	R/W	RX Torque Boost	0 - 15%	5	
H87	R/W	Stall Level	30 - 150%	150	
H88	Tune	1 Min Overload Level	50 - 200%	150	
H89	Tune	Continuous Overload Level	50 - H88	100	
H90	R/W	Motor Rated Current	0.1 - 50Amps	CALC	
H91	R/W	Parameter Read	0 = No 1 = Yes	0	
H92	R/W	Parameter Write	0 = No 1 = Yes	0	

Table B-1 Parameters Sorted by Parameter Number Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H93	R/W	Parameter Initialize	0 = No Action 1 = All parameters set to factory defaults. To reset individual groups only and not all parameters select one of the following: 2 = P Group Parameter Reset 3 = F Group Parameter Reset 4 = H Group Parameter Reset 5 = t Group Parameter Reset	0	
H94	Tune	Password Register	0-65535	0	
H95	Tune	Parameter Lock	0-65535	0	

B.2 Parameters Sorted by Parameter Name

Table B-2 Parameters Sorted by Parameter Name

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H88	Tune	1 Min Overload Level	50 - 200%	150	
F2	R/W	Accel Pattern	0=Linear 1=S-Curve	0	
H81	Tune	Accel Time	0 - 6000 Sec	1.00	
P41	Tune	Accel Time	0 - 6000 Sec	5.00	
H71	Tune	Accel/Decel Time Scale	0 = Setting Unit: 0.01 sec Range: 0.01- 600.00 1 = Setting Unit: 0.1 sec Range: 0.1- 6000.0 2 = Setting Unit: 1 sec Range: 1- 60000	1	
t38	Tune	Analog Input 0 to 10V (NV) Max Voltage	0 to 10V	10	
t36	Tune	Analog Input 0 to -10V (NV) Min Voltage	0 to 10V	0	
t40	Tune	Analog Input 0 to 10V (V1) Filter Time Constant	0 - 9999	10	
t41	Tune	Analog Input 0 to 10V (V1) Min Voltage	0 - 10V	0	
t43	Tune	Analog Input 0-10V (V1) Max Voltage	0 - 10V	10	
t45	Tune	Analog Input 0-20mA (I) Filter Time Constant	1-9999	10	
t48	Tune	Analog Input 0-20mA (I) Max Current	0-20mA	20	
t46	Tune	Analog Input 0-20mA (I) Min Current	0-20mA	4	
t29	Tune	Analog Output Level Adjustment	10 - 200%	100	
t28	Tune	Analog Output Select	0 = Output Frequency 1 = Output Current 2 = Output Voltage 3 = DC Link Voltage	0	
H21	Tune	Auto Restart	0 = No 1 = Yes	0	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H26	Tune	Auto Restart Attempts	0-10	0	
H27	Tune	Auto Restart Time	0-60Sec	1.00	
H41	R/W	Auto-Tuning	0-1	0	
H83	R/W	Base Freq	30-400Hz	60.00	
P34	R/W	Base Frequency	30-400Hz	60.00	
t61	Tune	Baud Rate	0 = 1200 bps 1 = 2400 bps 2 = 4800 bps 3 = 9600 bps 4 = 19200 bps	3	
t82	Tune	Brake Open Current	0-180 Amps	50.0	
t83	R/W	Brake Open Delay Time	0-10Sec	1.00	
t84	R/W	Brake Open FX Frequency	0-400Hz	1.00	
t85	R/W	Brake Open RX Frequency	0-400Hz	1.00	
t86	R/W	Brake Close Delay Time	0-10Sec	1.00	
t87	R/W	Brake Close Frequency	0-400Hz	2.00	
H39	Tune	Carrier Frequency Select	2-15kHz	3.0	
t59	R/W	Communication Protocol Select	0 = Modbus RTU 1 = CI485	0	
t64	Tune	Communication Time Setting	2-100 ms	5	
C36	R/W	Communication Update	0-1	0	
H89	Tune	Continuous Overload Level	50 - H88	100	
H40	R/W	Control Mode Select	0 = Volts/Frequency Control 1 = Slip Compensation Control 2 = Sensorless Vector Control	0	
H77	Tune	Cooling Fan Control	0 = Always ON 1 = Fan operates when temp above limit	0	
t35	Tune	Criteria for Analog Input Signal Loss	0 = Disabled 1 = Activated when less than half of set value 2 = Activated when less than set value	0	
n0n	RO	Current Fault Display	N/A	N/A	
H53	Tune	D Gain for PID	0-30.0Sec	0.00	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H76	Tune	DB Resistor Operating Rate	0-30%	10	
H75	Tune	DB Resistor Select	0 = Unlimited 1 = DB limited by H76	1	
F8	R/W	DC Brake Start Frequency	0.1-60Hz	5.00	
F13	R/W	DC Brake Start Time	0-60Sec	0	
F12	R/W	DC Brake Start Voltage	0-200%	50	
F11	R/W	DC Brake Time	0-60Sec	1.00	
F10	R/W	DC Brake Voltage	0-200%	50	
F9	R/W	DC Brake Wait Time	0-60Sec	0.10	
d6	RO	DC Link Voltage	Based on Drive Rating VDC	N/A	
F3	R/W	Decel Pattern	0 = Linear 1 = S-Curve	0	
P42	Tune	Decel Time	0 - 6000 Sec	10.00	
H82	Tune	Decel Time	0 - 6000 Sec	5.00	
t1	Tune	Digital Input 1	0 = Forward Run Command 1 = Reverse Run Command 2 = Output Inhibit 3 = Fault Reset (RST) 4 = Jog Speed Select (2Wire only) 5 = Speed Select1 6 = Speed Select2 7 = Speed Select3 8 = Ramp Select1 9 = Ramp Select2 10 = Ramp Select3 11 = DC Brake during start 12 = 2nd Motor Select 13 = Timer Maintained 14 = Timer Momentary 15 = Frequency increase (UP) 16 = Frequency decrease (DOWN) 17 = 3Wire Stop 18 = External Trip: A Contact (EtA) 19 = External Trip: B Contact (EtB) 20 = Self-Diagnostic Function 21 = Exchange between PID and V/F operation	0	
t2	Tune	Digital Input 2		1	
t3	Tune	Digital Input 3		2	
t4	Tune	Digital Input 4		3	
t5	Tune	Digital Input 5		4	
t6	Tune	Digital Input 6		5	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t7	Tune	Digital Input 7	22 = Exchange between second source and drive 23 = Analog Hold 24 = Accel/Decel Disable 25 = Up/Down Save Freq. Initialization 26 = Jog Forward 27 = Jog Reverse 28 = Timer Reset	6	
t8	Tune	Digital Input 8		7	
t32	Tune	Digital Output (MO)	0 = FDT-1 1 = FDT-2 2 = FDT-3 3 = FDT-4 4 = FDT-5 5 = Overload (OLt) 6 = Inverter Overload (LoIT) 7 = Motor Stall 8 = Over voltage trip (OV) 9 = Low voltage trip (LV) 10 = Inverter overheat (OH) 11 = Command Loss 12 = During run 13 = During stop 14 = During constant run 15 = During speed searching 16 = Wait time for run signal input 17 = Fault Output 18 = Cooling Fan Trip Alarm 19 = Brake Signal Select 20 = Timer Output	12	
t50	R/W	Digital Output (MO) On Delay	0 to 3,600Sec	0	
t52	R/W	Digital Output (MO) Off Delay	0 to 3,600Sec	0	
F70	R/W	Draw Control Select	0 = No Draw Control 1 = V1 (0-10V) Input 2 = I (0-20mA) Input 3 = V1 (-10-10V) Input	0	
F71	Tune	Draw Control Rate	0-100%	0.0	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
P46	R/W	Drive Start/Stop Source 2	0 = Keypad 1 = Terminal Mode 1 2 = Terminal Mode 2 3 = RS485 Communication 4 = Communication Module	1	
H7	R/W	Dwell Frequency	0.00 - 400Hz	5.00	
H8	R/W	Dwell Time	0-10 Sec	0.00	
F52	Tune	Electronic Thermal Level Continuous	50-F51%	10	
F51	Tune	Electronic Thermal Level for 1 Minute	F52-200%	150	
F50	Tune	Electronic Thermal Select	0 = No 1 = Yes	0	
F40	Tune	Energy Savings Level	0-30%	0	
C27	RO	Error Frame Number		0	
t34	Tune	Fault Relay Output	0-7	2	
C1	RO	FieldBus Option Name	dnEt, EnEt, PnEt	dnEt	
C3	Tune	FieldBus ID	0-63	1	
C4	Tune	FieldBus Baud Rate	125k-500kbps	125k	
C5		FieldBus LED Status			
t9	Tune	Filter Time Constant for Digital inputs	1 - 15	4	
F1	R/W	Forward/Reverse Run Disable	0 = Forward and Reverse run enable 1 = Forward run disable 2 = Reverse run disable	0	
d0	RO	Frequency Command	0.00 to Frequency High Limit (P36) Hz	N/A	
P37	Tune	Frequency Command	0-400Hz	0.00	
t37	Tune	Frequency Corresponding to t36	0-400Hz	0	
t39	Tune	Frequency Corresponding to t38	0-400Hz	60	
t42	Tune	Frequency Corresponding to t41	0-400Hz	0	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t44	Tune	Frequency Corresponding to t43	0-400Hz	60	
t47	Tune	Frequency Corresponding to t46	0-400Hz	0	
t49	Tune	Frequency Corresponding to t47	0-400Hz	60	
t31	Tune	Frequency Detection Bandwidth	0-400Hz	10	
t30	Tune	Frequency Detection Level	0-400Hz	30	
P36	R/W	Frequency High Limit	0-400Hz	60.00	
t62	Tune	Frequency Loss Mode	0 = Continue operation at last frequency command 1 = Coast to Stop 2 = Decelerate to stop	0	
t63	Tune	Frequency Loss Wait Time	0.1-120Sec	1.00	
P35	R/W	Frequency Low Limit	0 - P36Hz	10.00	
H70	R/W	Frequency Reference for Accel/Decel	0 - Based on P36 – Frequency High Limit 1 - Based on Delta Frequency	0	
P40	R/W	Frequency Setting Method	1 = Digital Keypad 2 = Analog V1 1: ± 10V 3 = Analog V1 2: 0 to +10 V 4 = Analog Terminal I: 0 - 20mA 5 = Analog Terminal V1 Mode 1 6 = Analog Terminal V1 Mode 2 7 = Analog RS485 8 = MOP Reference 9 = Communication Module	1	
P47	R/W	Frequency Setting Mode 2	1 = Digital Keypad 2 = Analog V1 1: ± 10V 3 = Analog V1 2: 0 to +10 V 4 = Analog Terminal I: 0 - 20mA 5 = Analog Terminal V1 Mode 1 6 = Analog Terminal V1 Mode 2 7 = Analog RS485 8 = Communication Module	1	
H85	R/W	FX Torque Boost	0 - 15%	5	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H74	Tune	Gain for Motor RPM Display	1 - 1000%	100	
H52	Tune	I Gain for PID	0.1-32.0Sec	1.00	
C6	R/W	In Instance	70-144	70	
d7	RO	Input Terminal Status Display	N/A	N/A	
t60	Tune	Inverter Number	1-250	1	
F20	Tune	Jog Frequency	0-400Hz	10.00	
C0	Tune	Jump Code	0-99	1	
F0	Tune	Jump Code	0-99	1	
H0	Tune	Jump Code	0 - 99	1	
P0	Tune	Jump Code	30 -99	30	
t0	Tune	Jump Code	0 - 99	1	
H64	R/W	KEB Drive Select	0 = No 1 = Yes	0	
H65	R/W	KEB Action Start Level	110-140%	125	
H66	R/W	KEB Action Stop Level	110-145%	130	
H67	R/W	KEB Action Gain	1-20000	1000	
t57	Tune	Keypad Error Output	0 = Not used 1 = Signal output to MO 2 = Signal output to 3A, 3B contacts 3 = Signal output to MO, 3A, 3B	0	
H1	RO	Last Fault 1	N/A	nOn	
H2	RO	Last Fault 2	N/A	nOn	
H3	RO	Last Fault 3	N/A	nOn	
H4	RO	Last Fault 4	N/A	nOn	
H5	RO	Last Fault 5	N/A	nOn	
H44	R/W	Leakage Inductance (Ls)	0-300.0 mH	Calc	
H37	R/W	Load Inertia Rate	0 = Load inertia rate < 10 times motor inertia 1 = Load inertia rate ≈ 10 times motor inertia 2 = Load inertia rate > 10 times motor inertia	0	
H48	R/W	PWM Mode Select	0 = Normal PWM 1 = 2 Phase PWM	0	
F65	R/W	MOP Mode Select	0 = Reference changed between P35 and P36 1 = Speed change after edge input 2 = Combination of 0 and 1	0	
F66	R/W	MOP Step Frequency	0-400Hz	0.00	
F53	Tune	Motor Cooling Method	0 = Standard Motor 1 = Variable Speed Motor	0	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H36	R/W	Motor Efficiency	50-100%		
P30	R/W	Motor HP Select	0.5 = 0.5 HP 1 = 1 HP 2 = 2 HP 3 = 3 HP 5 = 5 HP 7.5 = 7.5 HP 10 = 10 HP 15 = 15 HP 20 = 20 HP 25 = 25 HP 30 = 30 HP	Calc	
H90	R/W	Motor Rated Current	0.1 - 50 Amps	Calc	
P32	R/W	Motor Rated Current	0.5 - 50 Amps	Calc	
d1	RO	Motor RPM	0 Motor RPM (based on P33 Motor Poles)	N/A	
C28	RO	Nak Frame Number		0	
H34	R/W	No Load Motor Current	0.1-20A	Calc	
H78	Tune	Operating Method when Cooling Fan Fails	0 = Continuous 1 = Stop when fan fails	0	
C16	R/W	Out Instance	20-124	20	
d2	RO	Output Current	0.0 to Motor Rated Current (P32) Amps	N/A	
d4	RO	Output Power	0.00 to (Drive Rated Power x 2) kW	N/A	
d8	RO	Output Terminal Status Display	N/A	N/A	
d5	RO	Output Torque	0.00 to (Drive Rated Torque x 2) [kgf / M]	N/A	
d3	RO	Output Voltage	0.0 to Drive Rated Voltage VAC	N/A	
F39	R/W	Output Voltage Adjustment	40-1 10%	100	
F56	Tune	Overload Trip Enable	0 = No 1 = Yes	1	
F57	Tune	Overload Trip Level	30-200%	180	
F58	Tune	Overload Trip Tme	0-60Sec	60	
F54	R/W	Overload Warning Level	30-150%	150	
F55	Tune	Overload Warning Time	0-30Sec	10	
H51	Tune	P Gain for PID	0-999.9%	300.00	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
C17	R/W	Parameter Control Number	0-4	0	
C18	R/W	Parameter Control 1	0x0000 - 0xFFFF	0x0000	
C19	R/W	Parameter Control 2	0x0000 - 0xFFFF	0x0000	
C20	R/W	Parameter Control 3	0x0000 - 0xFFFF	0x0000	
C21	R/W	Parameter Control 4	0x0000 - 0xFFFF	0x0000	
H93	R/W	Parameter Initialize	0 = No Action 1 = All parameters set to factory defaults. To reset individual groups only, select one of the following: 2 = P Group Parameter Reset 3 = F Group Parameter Reset 4 = H Group Parameter Reset 5 = t Group Parameter Reset	0	
H95	Tune	Parameter Lock	0-65535	0	
H91	R/W	Parameter Read	0 = No 1 = Yes	0	
C7	R/W	Parameter Status Number	0-4	0	
C8	Tune	Parameter Status 1	0x0000 - 0xFFFF	0x0000	
C9	Tune	Parameter Status 2	0x0000 - 0xFFFF	0x0000	
C10	Tune	Parameter Status 3	0x0000 - 0xFFFF	0x0000	
C11	Tune	Parameter Status 4	0x0000 - 0xFFFF	0x0000	
H92	R/W	Parameter Write	0 = No 1 = Yes	0	
t65	Tune	Parity/Stop Bit Setting	0 = Parity: None, Stop Bit: 1 1 = Parity: None, Stop Bit: 2 2 = Parity: Even, Stop Bit: 1 3 = Parity: Odd, Stop Bit: 1	0	
H94	Tune	Password Register	0-65535	0	
H19	Tune	Phase Loss Protection	0 = Not Used 1 = Output phase loss protection 2 = Input phase loss protection 3 = Input/output phase loss protection	0	
d10		PID Control Feedback Amount		N/A	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
P48	Tune	PID Control Standard Value Setting	0-400Hz or 0.00 to 100%	0.00	
H54	R/W	PID Control Mode	0 = Normal PID Control 1 = Process PID Control	0	
H49	R/W	PID Control Select	0 = No 1 = Yes	0	
H50	R/W	PID Feedback Selection	0 = Terminal I Input (0-20 mA) 1 = Terminal V1 Input (0-10V)	0	
H55	Tune	PID Output Frequency High Limit	H56- 400Hz	60.00	
H56	Tune	PID Output Frequency Low Limit	P35 Min, H55 Max	0.50	
H57	R/W	PID Reference Select	0 = Keypad setting 1 1 = Keypad setting 2 2 = V1 terminal 0-10V 3 = I terminal 0-20mA 4 = RS485 Communications	0	
H58	R/W	PID Units	0-1 (Hz or %)	0	
P33	R/W	Pole Number	2, 4, 6, 8, 10, 12	4	
H20	Tune	Power On Start	0 = No 1 = Yes	0	
H72	Tune	Power-On Display	0 = Frequency Command 1 = Motor RPM 2 = Output Current 3 = Output Voltage 4 = Output Power 5 = Output Torque 6 = DC Link Voltage 7 = Digital Input Status 8 = Digital Output Status 9 = Software Version	0	
P43	Tune	Preset Speed 1	0 - 400Hz	10.00	
P44	Tune	Preset Speed 2	0 - 400Hz	20.00	
P45	Tune	Preset Speed 3	0 - 400Hz	30.00	
t10	Tune	Preset Speed 4	0-400Hz	30	
t11	Tune	Preset Speed 5	0-400Hz	25	
t12	Tune	Preset Speed 6	0-400Hz	20	
t13	Tune	Preset Speed 7	0-400Hz	15	
t14	Tune	Preset Speed Accel Time 1	0-6000Sec	3.00	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t16	Tune	Preset Speed Accel Time 2	0-6000Sec	4.00	
t18	Tune	Preset Speed Accel Time 3	0-6000Sec	5.00	
t20	Tune	Preset Speed Accel Time 4	0-6000Sec	6.00	
t22	Tune	Preset Speed Accel Time 5	0-6000Sec	7.00	
t24	Tune	Preset Speed Accel Time 6	0-6000Sec	8.00	
t26	Tune	Preset Speed Accel Time 7	0-6000Sec	9.00	
t15	Tune	Preset Speed Decel Time 1	0-6000Sec	3.00	
t17	Tune	Preset Speed Decel Time 2	0-6000Sec	4.00	
t19	Tune	Preset Speed Decel Time 3	0-6000Sec	5.00	
t21	Tune	Preset Speed Decel Time 4	0-6000Sec	6.00	
t23	Tune	Preset Speed Decel Time 5	0-6000Sec	7.00	
t25	Tune	Preset Speed Decel Time 6	0-6000Sec	8.00	
t27	Tune	Preset Speed Decel Time 7	0-6000Sec	9.00	
t66	Tune	Read Address Register 1	0-42239	0005	
t67	Tune	Read Address Register 2	0-42239	0006	
t68	Tune	Read Address Register 3	0-42239	0007	
t69	Tune	Read Address Register 4	0-42239	0008	
t70	Tune	Read Address Register 5	0-42239	0009	
t71	Tune	Read Address Register 6	0-42239	000A	
t72	Tune	Read Address Register 7	0-42239	000B	
t73	Tune	Read Address Register 8	0-42239	000C	
C26	RO	Receive Frame Number		0	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t33	Tune	Relay Output (3A - 3C)	0 = FDT-1 1 = FDT-2 2 = FDT-3 3 = FDT-4 4 = FDT-5 5 = Overload (OLt) 6 = Inverter Overload (IoIT) 7 = Motor Stall 8 = Over voltage trip (OV) 9 = Low voltage trip (LV) 10 = Inverter overheat (OH) 11 = Command Loss 12 = During run 13 = During stop 14 = During constant run 15 = During speed searching 16 = Wait time for run signal input 17 = Fault Output 18 = Cooling Fan Trip Alarm 19 = Brake Signal Select 20 = Timer Output	17	
t51	R/W	Relay Output (3A - 3C) On Delay	0 to 3,600Sec	0	
t53	R/W	Relay Output (3A - 3C) Off Delay	0 to 3,600Sec	0	
H6	Tune	Reset Fault History	0 = No 1 = Yes		
H86	R/W	RX Torque Boost	0 - 15%	5	
F63	R/W	Save Up/Down Frequency	0 = No 1 = Yes	0	
F64	Tune	Saved Up/Down frequency	0-400Hz	0.00	
H18	R/W	S-Curve Accel/ Decel End Side	1-100%	40	
H17	R/W	S-Curve Accel/ Decel Start Side	1-100%	40	
H60	R/W	Self Diagnostics Select	0 = Self-diagnostic disabled 1 = IGBT fault/ground fault 2 = Output phase short & open/ground fault 3 = Ground Fault	0	
H46	Tune	Sensorless I Gain	0-32767	100	
H45	Tune	Sensorless P Gain	0-32767	1000	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
H47	R/W	Sensorless Torque Limit	100-220%	180	
H10	R/W	Skip Frequency Enable	0 = No 1 = Yes	0	
H12	R/W	Skip Frequency High Limit 1	H11 - 400Hz	15	
H14	R/W	Skip Frequency High Limit 2	H13 - 400Hz	25	
H16	R/W	Skip Frequency High Limit 3	H15 - 400Hz	35	
H11	R/W	Skip Frequency Low Limit 1	0 - H12 Hz	10	
H13	R/W	Skip Frequency Low Limit 2	0 -H14 Hz	20	
H15	R/W	Skip Frequency Low Limit 3	0 - H16 Hz	30	
H61	R/W	Sleep Delay Time	0-2000Sec	60	
H62	Tune	Sleep Frequency	0-400Hz	0	
F72	R/W	Sleep Mode Boost Enable	0 = Boost Disable 1 = Boost Enable	0	
F74	Tune	Sleep Mode Boost Frequency	0 - Max. Frequency (P36)	30	
F73	R/W	Sleep Mode Boost Time	0 - 120 sec	10	
H32	R/W	Slip Frequency	0-10Hz	1.67	
C2		Software Version			
d9	RO	Software Version	1.0 to 99.9	N/A	
H23	Tune	Speed Search Current Level	80-200%	100	
H25	Tune	Speed Search I Gain	0-9999	200	
H24	Tune	Speed Search P Gain	0-9999	100	
H22	R/W	Speed Search Select	0-15	0	
H87	R/W	Stall Level	30 - 150%	150	
F61	R/W	Stall Prevention during Deceleration	0 = No 1 = Yes	0	
F60	R/W	Stall Prevention Level	30-200%	150	
F59	R/W	Stall Prevention Select	0-7	0	
F67	R/W	Start Frequency	0.10 to 10.00Hz	0.5	
H42	R/W	Stator Resistance (Rs)	0-28 Ohms	Calc	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
P39	R/W	Stop Type	0 = Decelerate to Stop (Ramp) 1 = DC Brake to Stop 2 = Coast to Stop 3 = Power Braking	0	
P38	R/W	Stop/Start Source	0 = Keypad 1 = Terminal Mode 1 2 = Terminal Mode 2 3 = RS485 Communication 4 = Communication Module	0	
F14	R/W	Time for Magnetizing a Motor	0-60 Sec	0.10	
t54	R/W	Timer Value	0 to 3,600Sec	5	
F28	R/W	Torque Boost in Forward Direction	0-15%	2	
F29	R/W	Torque Boost in Reverse Direction	0-15%	2	
F27	R/W	Torque Boost Select	0 = Manual Torque Boost 1 = Auto Torque Boost	0	
F31	R/W	User V/F Frequency 1	0 - 400Hz	15	
F33	R/W	User V/F Frequency 2	0 - 400Hz	30	
F35	R/W	User V/F Frequency 3	0 - 400Hz	45	
F37	R/W	User V/F Frequency 4	0 - 400Hz	60	
F32	R/W	User V/F Voltage 1	0-100%	25	
F34	R/W	User V/F Voltage 2	0-100%	50	
F36	R/W	User V/F Voltage 3	0-100%	75	
F38	R/W	User V/F Voltage 4	0-100%	100	
F30	R/W	V/F Pattern	0 = Linear 1 = Square 2 = User V/F	0	
H84	R/W	V/F Pattern	0 = Linear 1 = Square 2 = User V/F	0	
H63	Tune	Wake-Up Level	0-100%	35	
t74	Tune	Write Address Register 1	0-42239	0005	

Table B-2 Parameters Sorted by Parameter Name Continued

Param #	Access	Parameter Name	Description (Range)	Factory Setting	User Setting
t75	Tune	Write Address Register 2	0-42239	0006	
t76	Tune	Write Address Register 3	0-42239	0007	
t77	Tune	Write Address Register 4	0-42239	0008	
t78	Tune	Write Address Register 5	0-42239	0005	
t79	Tune	Write Address Register 6	0-42239	0006	
t80	Tune	Write Address Register 7	0-42239	0007	
t81	Tune	Write Address Register 8	0-42239	0008	

Appendix C
CE Guidelines

C.1 CE Declaration of Conformity

Baldor indicates that the products are only components and not ready for immediate or instant use within the meaning of “Safety law of appliance”, “EMC Law” or “Machine directive”. The final mode of operation is defined only after installation into the user’s equipment. It is the responsibility of the user to verify compliance.

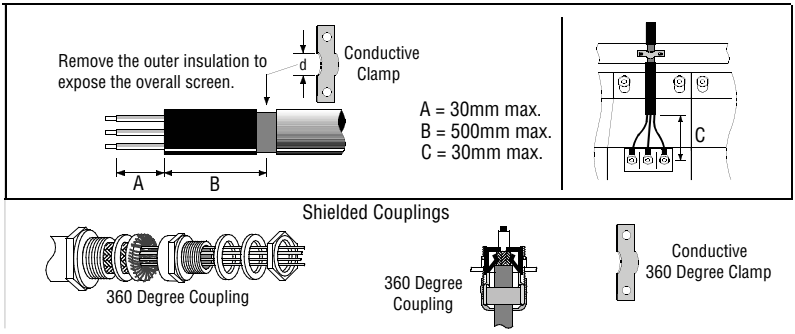
The drives that have been evaluated for EMC bear the CE mark.

C.2 EMC - Conformity and CE Marking

The information contained herein is for your guidance only and does not guarantee that the installation will meet the requirements of the council directive 89/336/EEC.
The purpose of the EEC directives is to state a minimum technical requirement common to all the member states within the European Union. In turn, these minimum technical requirements are intended to enhance the levels of safety both directly and indirectly.
Council directive 89/336/EEC relating to Electro Magnetic Compliance (EMC) indicates that it is the responsibility of the system integrator to ensure that the entire system complies with all relative directives at the time of installing into service.
Motors and controls are used as components of a system, per the EMC directive. Hence all components, installation of the components, interconnection between components, and shielding and grounding of the system as a whole determines EMC compliance.
The CE mark does not inform the purchaser which directive the product complies with. It rests upon the manufacturer or his authorized representative to ensure the item in question complies fully with all the relative directives in force at the time of installing into service, in the same way as the system integrator previously mentioned. Remember, it is the instructions of installation and use, coupled with the product, that comply with the directive.

Note that this drive is commercial in design; not for residential environments.

Figure C-1 Wiring of Shielded (Screened) Cables



C.3 EMC Installation Options

When installed for Class A or Class B operation, the control is compliant with EN55011 (1991)/ EN55022 (1994) for radiated emissions as described.

C.4 Grounding for Wall Mounting (Class A) also see Chapters 4 and 5

Top cover must be installed.

- A single-star point (earth) is required.
- The protective earth connection (PE) to the motor must be run inside the screened cable or conduit between the motor and control and be connected to the protective earth terminal at the control.
- The internal/external AC supply filter must be permanently earthed.
- The signal/control cables must be screened.

C.5 Grounding for Enclosure Mounting (Class B) also see Chapters 4 and 5

- The unit is installed for Class B operation when mounted inside an enclosure that has 10dB attenuation from 30 to 100MHz (typically the attenuation provided by a metal cabinet with no opening greater than 0.15m), using the recommended AC supply filter and having met all cable requirements.

Note: Radiated magnetic and electric fields inside the cubicle will be high and components installed inside must be sufficiently immune.

- The control, external filter and associated equipment are mounted onto a conducting, metal panel. Do not use enclosures that use insulating mounting panels or undefined mounting structures. Cables between the control and motor must be screened or in conduit and terminated at the control.

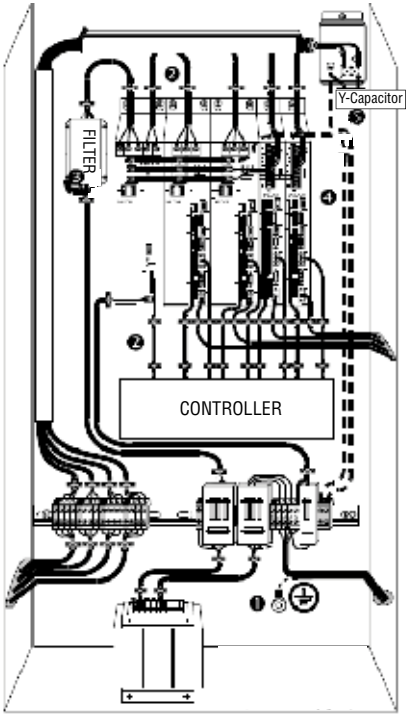
C.6 Using CE approved components will not guarantee a CE compliant system

1. The components used in the drive, installation methods used, materials selected for interconnection of components are important.
2. The installation methods, interconnection materials, shielding, filtering and grounding of the system as a whole will determine CE compliance.
3. The responsibility of CE mark compliance rests entirely with the party who offers the end system for sale (such as an OEM or system integrator).

Baldor products which meet the EMC directive requirements are indicated with a “CE” mark. A signed CE declaration of conformity is provided in this section.

C.7 EMC Wiring Technique

Figure C-2 EMC Wiring Technique



1 CABINET
The drawing shows an electroplated zinc coated enclosure, which is connected to ground.
This enclosure has the following advantages:
- All parts mounted on the back plane are connected to ground.
- All shield (screen) connections are connected to ground.
Within the cabinet there should be a spatial separation between power wiring (motor and AC power cables) and control wiring.

2 SCREEN CONNECTIONS
All connections between components must use shielded cables. The cable shields must be connected to the enclosure. Use conductive clamps to ensure good ground connection. With this technique, a good ground shield can be achieved.

3 EMC - FILTER
The EMI or main filter should be mounted next to the power supply (here BPS). For the connection to and from the main filter, screened cables should be used. The cable screens should be connected to screen clamps on both sides. (Exception: Analog Command Signal).

4 GROUNDING (EARTH)
For safety reasons (VDE0160), all Baldor components must be connected to ground with a separate wire. The diameter of the wire must be at minimum AWG#6 (10mm^2). Ground connections (dashed lines) must be made from the central ground to the regen resistor enclosure and from the central ground to the Shared Power Supply.

5 Y-CAPACITOR
The connection of the regeneration resistor can cause RFI (radio frequency interference) to be very high. To minimize RFI, a Y-capacitor is used. The capacitor should only be connected between the dynamic brake resistor housing and terminal pin R1.

Attention: The drawing shows only the principle of an EMC wiring. The installation shown can be different to any national standard (e.g. VDE).

C.8 EMC Installation Instructions

To ensure electromagnetic compatibility (EMC), the following installation instructions should be completed. These steps help to reduce interference.
Consider the following:

- Grounding of all system elements to a central ground point
- Shielding of all cables and signal wires
- Filtering of power lines

A proper enclosure should have the following characteristics:

A) All metal conducting parts of the enclosure must be electrically connected to the back plane. These connections should be made with a grounding strap from each element to a central grounding point. [1]

B) Keep the power wiring (motor and power cable) and control wiring separated. If these wires must cross, be sure they cross at 90 degrees to minimize noise due to induction.

C) The shield connections of the signal and power cables should be connected to the screen rails or clamps. The screen rails or clamps should be conductive clamps fastened to the cabinet. [2]

D) The cable to the regeneration resistor must be shielded. The shield must be connected to ground at both ends.

E) The location of the AC mains filter has to be situated close to the drive so the AC power wires are as short as possible.

F) Wires inside the enclosure should be placed as close as possible to conducting metal, cabinet walls and plates. It is advised to terminate unused wires to chassis ground. [1]

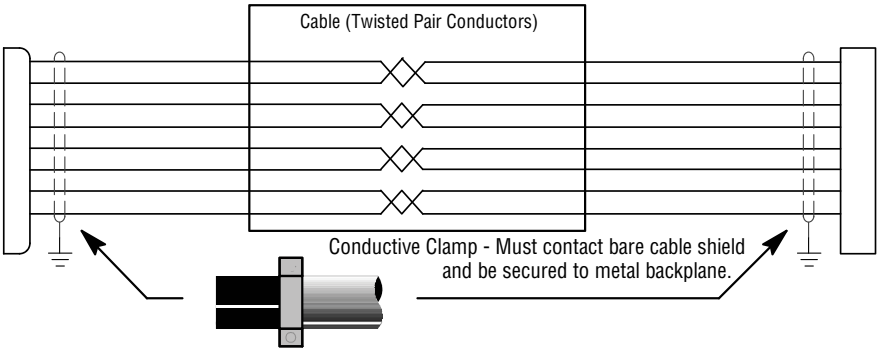
G) To reduce ground current, use at least a 10mm^2 (6 AWG) solid wire for ground connections.

[1] Grounding in general describes all metal parts which can be connected to a protective conductor, e.g. housing of cabinet, motor housing, etc. to a central ground point. This central ground point is then connected to the main plant (or building) ground.

[2] Or run as twisted pair at minimum.

Example Cable Screens Grounding

Figure C-3 Example Cable Screens Grounding



Appendix D
Options and Kits

D.1 Remote Keypad Option

CAUTION: **Only Baldor cables should be used to connect the keypad and control. These are special twisted pair cables to protect the control and keypad. Damage associated with other cable types are not covered by the Baldor warranty.**

Identify that you have the remote keypad and remote keypad connector, Figure D-1.

Figure D-1 Remote Keypad Connector

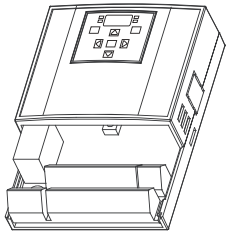


Table D-1 Remote Keypad and Cable Models

Model number	Description
VS1MD-RKEY2	INV - Remote - 2 meter length (6.5 ft)
VS1MD-RKEY3	INV - Remote - 3 meter length (9.8 ft)
VS1MD-RKEY5	INV - Remote - 5 meter length (16.4 ft)

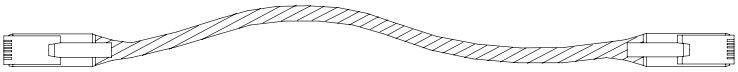
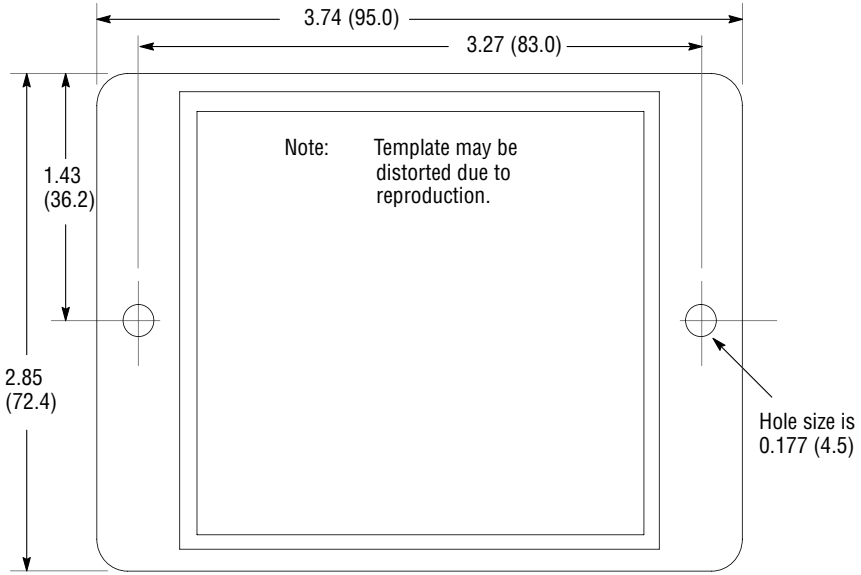


Figure D-2 Keypad Mounting Hole Location



1. Drill two mounting holes in the locations shows using Figure D-2 as a template.
2. Remove the keypad from the VS1MD.
3. Mount the remote keypad.
4. Remove the plastic knockout to reveal the Remote Keypad connector shown in Figure D-1.
5. Attach one end of the remote cable in the keypad connector of the control.
6. Attach the other end of the remote cable to the remote keypad.

D.2 Conduit Kit

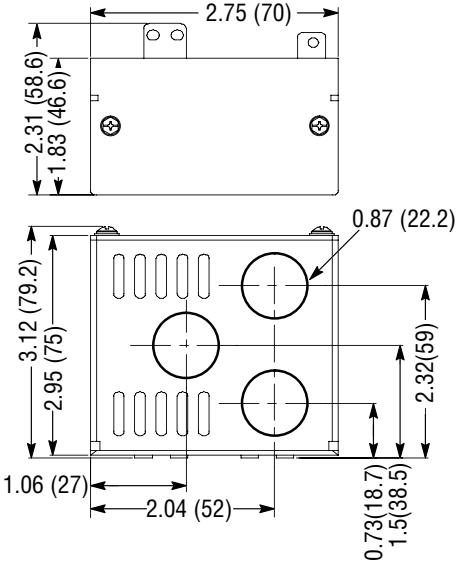
Table D-2 identifies each conduit kit by part number.

Table D-2 Conduit Kit Models

Conduit Kit	Description
VS1MD-NM1A	0.5 and 1.0 HP (0.4 and 0.75 kW)
VS1MD-NM1B	2.0 HP (1.5 kW)
VS1MD-NM1C	3.0 and 5.0 HP (2.2 and 4.0 kW)
VS1MD-NM1D	7.5 and 10.0 HP (5.5 and 7.5 kW)
VS1MD-NM1E	15 and 20 HP (11 and 15 kW)
VS1MD-NM1F	25 and 30 HP (18.5 and 22 kW)

Figure D-3 Conduit Kit for VS1MD-NM1A, VS1MD-NM1C

VS1MD-NM1A



VS1MD-NM1C

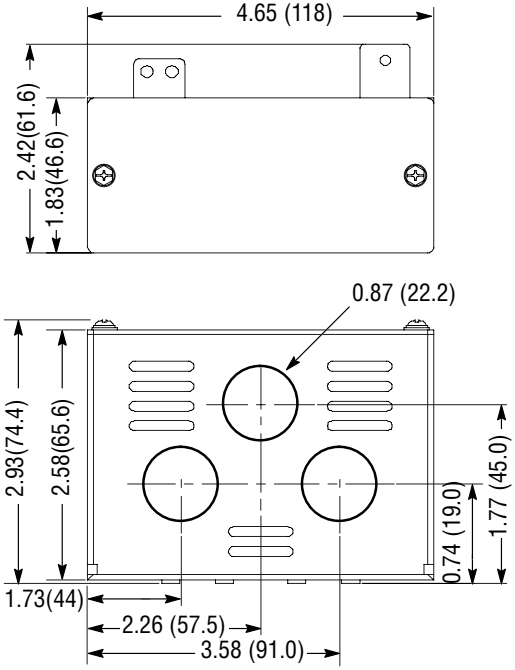


Figure D-4 Conduit Kit for VS1MD-NM1B, VS1MD-NM1D

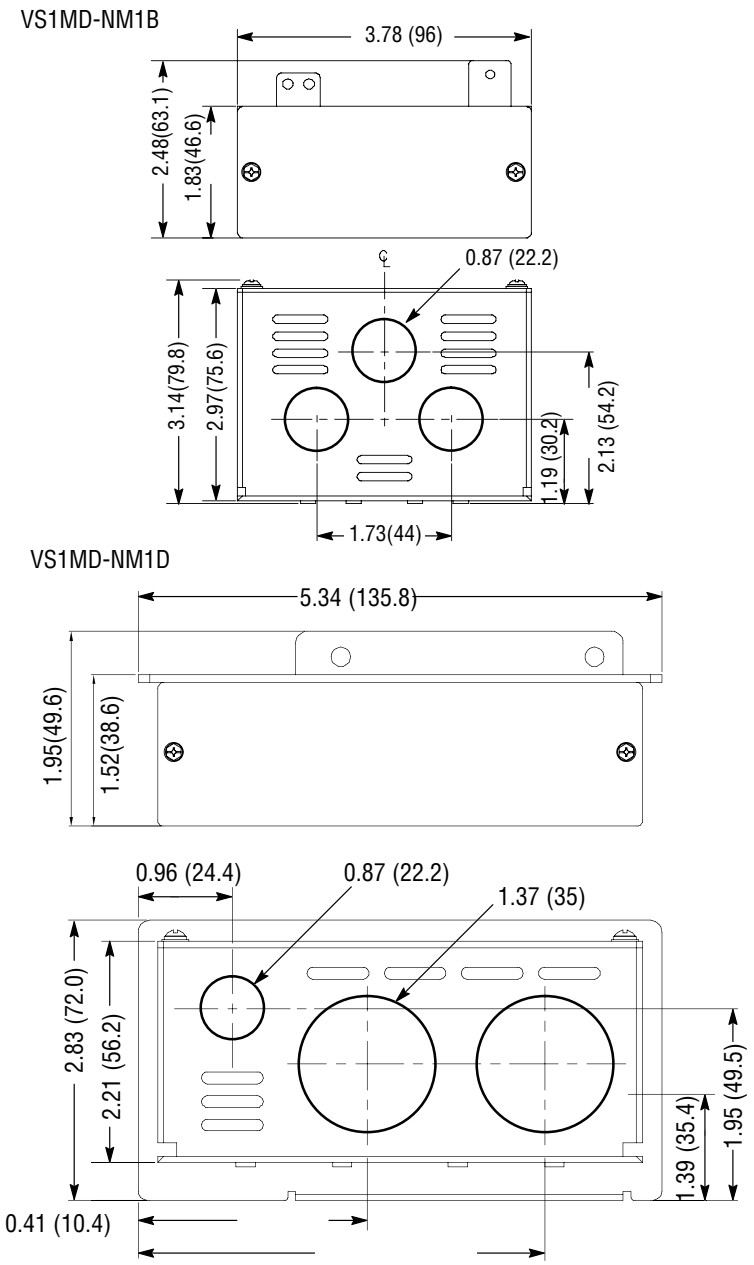
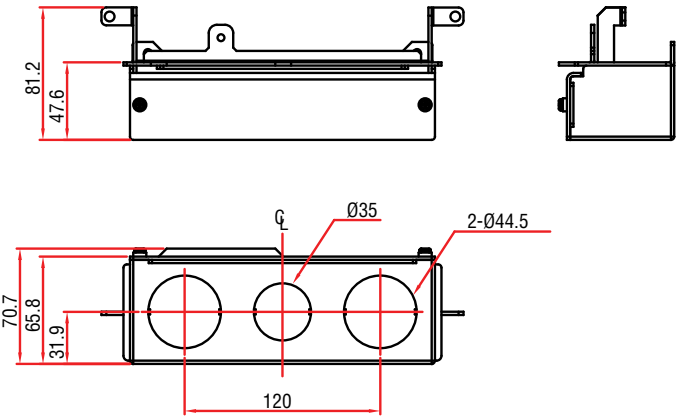
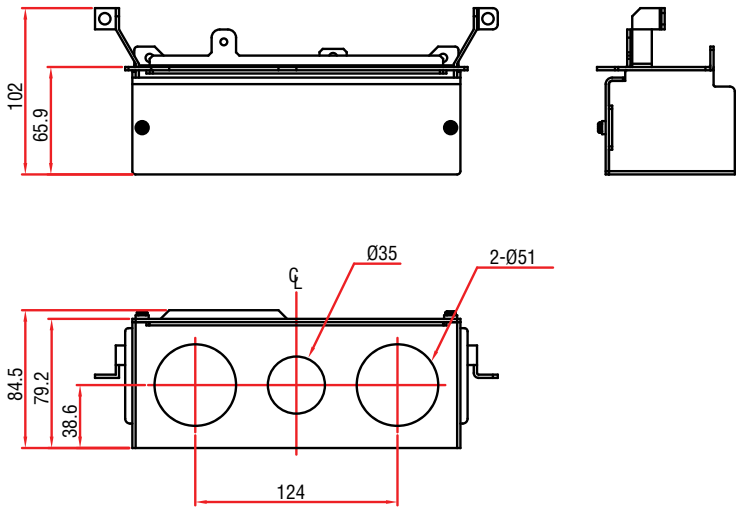


Figure D-5 Conduit Kit for VS1MD-NM1E, VS1MD-NM1F

15kW



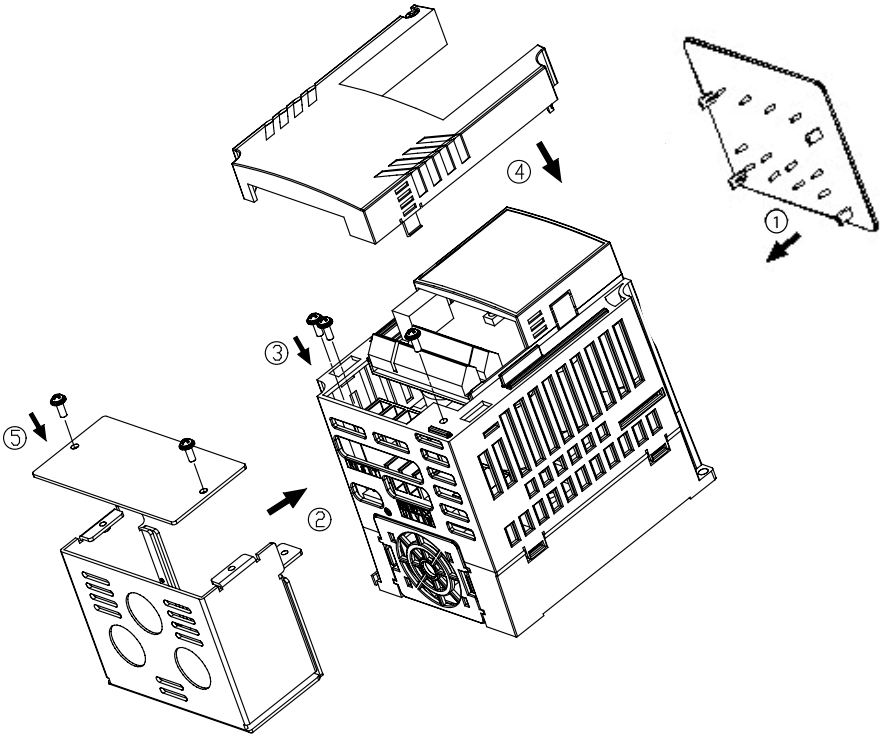
22kW



D.3 Conduit Kit Installation Procedure:

1. Remove the VS1MD cover, see Chapter 3.
2. Remove the Conduit box cover, Figure D-6.
3. Attach Conduit box to control, Figure D-6.
4. Attach Conduit to Conduit box.
5. Install wires through conduit into control and make all connections.
6. Install Conduit box cover.
7. Install VS1MD cover.
8. Install Drip Cover (only required on drives 10HP and smaller).

Figure D-6 Conduit Kit Diagram



D.4 Brake Resistor

Table D-3 Brake Resistor

Input Voltage	Inverter capacity HP (kW)	100% Braking		150% Braking	
		Ohm	Watt *	Ohm	Watt *
230	0.5 (0.4)	400	50	300	100
	1.0 (0.75)	200	100	150	150
	2.0 (1.5)	100	200	60	300
	3.0 (2.2)	60	300	50	400
	5.0 (3.7)	40	500	33	600
	7.5 (5.5)	30	700	20	800
	10.0 (7.5)	20	1000	15	1200
	15 (11)	15	1400	10	2400
	20 (15)	11	2000	8	2400
	25 (18.5)	9	2400	5	3600
	30 (22)	8	2800	5	3600
460	0.5 (0.4)	1800	50	1200	100
	1.0 (0.75)	900	100	600	150
	2.0 (1.5)	450	200	300	300
	3.0 (2.2)	300	300	200	400
	5.0 (3.7)	200	500	130	600
	7.5 (5.5)	120	700	85	1000
	10.0 (7.5)	90	1000	60	1200
	15 (11)	60	1400	40	2000
	20 (15)	45	2000	30	2400
	25 (18.5)	35	2400	20	3600
	30 (22)	30	2800	10	3600

***** The wattage is based on Enable duty (%ED) 5% with continuous braking time 15 sec.

Appendix E

RS485 Protocol

E.1 Installation

1. Connect the RS485 communication line to the inverter (S+), (S-) terminals of the control terminals.
2. Check the connection and turn ON the inverter.
3. If the communication line is connected correctly, set the communication-related parameters as follows:
   - P38 [Drive mode]: 3(RS485)
   - P40 [Freq. mode]: 7(RS485)
   - t60 [Inv. Number]: 1 to 250 (If multiple inverters are connected, be sure to use different numbers for each inverter)
   - t61 [Baud-rate]: 3 (9,600 bps as Factory default)
   - t62 [Lost Mode]: 0 - No action (Factory default)
   - t63 [Time-Out]: 1.0 sec (Factory default)
   - t59 [Comm. Prot]: 0 - Modbus-RTU
4. Connection to PC
   The maximum number of drives that can be connected is 31.
   Maximum length of communication line is 2300 ft (700m).

E.2 Operation

1. Verify computer and the inverter connections.
2. Turn ON the inverter. But do not connect the load until stable communication between the computer and the inverter is verified.
3. Start the operating program for the inverter from the computer.
4. Operate the inverter using the operating program for the inverter.
5. Refer to Chapter 9 “Troubleshooting” if the communication is not operating normally.

Note: The User program of the “DriveView” program supplied from Baldor Electric can be used as the operating program for the drive.

E.3 Performance Specifications

Table E-1 Performance Specifications

Item	Specification
Communication Method	RS485
Transmission Form	Bus method, Mult-drop Link System
Applicable drive	VS1MD
Converter (R232 to RS485)	Converter with RS232 card embedded
Connectable drives	Maximum 31 drives connectable
Transmission distance	Less than 700m recommended (Max. 1200m)

E.4 Hardware Specifications

Table E-2 Hardware Specifications

Item	Specification
Installation	Use S+, S- terminals on control terminal block
Power supply	Provided by isolated power from the inverter power supply

E.5 Communications Specifications

Table E-3 Communications Specifications

Item	Specification
Communication Speed	19200, 9600, 4800, 2400, 1200 bps selectable
Control Procedure	Asynchronous communication system
Communication System	Half duplex system
Characters	ASCII (8 bit)
Stop bits	CI485 =1 bit, Modbus RTU = 2 bits
Check Sum	2 bytes
Parity Check	None

E.6 Communications Protocol (MODBUS-RTU)

Use Modbus-RTU protocol (Open Protocol)
Computer or other hosts can be Master and inverters Slave. Inverter responds to Read/Write command from Master.

Table E-4 Supported Function Calls

Function Code	Description
0x03	Read Hold Register
0x04	Read Input Register
0x06	Preset Single Register
0x10	Preset Multiple Register

Table E-5 Exception Codes

Function Code	Description
0x01	Illegal Function
0x02	Illegal Data Address
0x03	Illegal Data Value
0x06	Slave Device Busy
User Defined 0x14	1. Write disable (0x004=0) 2. Read only or not program while running

E.7 Modbus RTU Communications

Table E-6 Parameters

Parameter Number	Parameter Description
P38/46	Start Stop Source 1 and 2
P40/47	Frequency Setting Method 1 and 2
t59	Communications Protocol Select
t60	Inverter (DROP) Number
t61	Baud Rate
t62	Frequency Loss Mode
t63	Frequency Loss Wait Time
t64	Communications Time Setting
t65	Parity / Stop Bit Setting
t66	Read Address Register 1
t67	Read Address Register 2
t68	Read Address Register 3
t69	Read Address Register 4
t70	Read Address Register 5
t71	Read Address Register 6
t72	Read Address Register 7
t73	Read Address Register 8
t74	Write Address Register 1
t75	Write Address Register 2
t76	Write Address Register 3
t77	Write Address Register 4
t78	Write Address Register 5
t79	Write Address Register 6
t80	Write Address Register 7
t81	Write Address Register 8

Note: User can register up to 8 discontinuous addresses and read/write them all with one read/write command.

Default Values t66=5, t67=6, t68=7, t69=8, t70=9, t71=10, t72=11, t73=12, t74=5, t75=6, t76=7, t77=8, t78=5, t79=6, t80=7, t81=8,
The user can register up to 8 discontinuous addresses and read them all with one read command.
The user can register up to 8 discontinuous addresses and Write them all with one Write command.

E.7.1 Communication Specification

Item	Specification
Communication speed	19,200/9,600/4,800/2,400/1,200 bps selectable
Control procedure	Asynchronous communication system
Communication system	Half duplex system
Character system	ASCII (8 bit)
Stop bit length	Modbus-RTU: 2 bit LS Bus: 1 bit
Sum check	2 byte
Parity check	None

E.7.2 Installation

E.7.2.1 Connecting the Communication Line

- Connect the RS-485 communication line to the inverter's (S+), (S-) terminals of the control terminals.
- Check the connection and turn ON the inverter.
- If the communication line is connected correctly set the communication-related parameters as the following:

  P38 [Drive mode]: 3(RS485)
  P40 [Freq. mode]: 7(RS485)
  t60 [Inv. Number]: 1~250 (If more than 1 inverters are connected, be sure to use different numbers for each inverter)
  t61 [Baud-rate]: 3 (9,600 bps as Factory default)
  t62 [Lost Mode]: 0 - No action (Factory default)
  t63 [Time-Out]: 1.0 sec (Factory default)
  t59 [Comm. Prot]: 0 - Modbus-RTU, 1 – LS BUS

- The number of drives to be connected is up to 31 drives.
- The specification of length of communication line is max. 1200m. To ensure stable communication, limit the length below 700m.

E.7.2.2 Operational Steps

1. Check whether the computer and the drive are connected correctly.
2. Turn ON the inverter. But do not connect the load until stable communication between the computer and the inverter is verified.
3. Start the operating program for the Drive from the computer.
4. Operate the inverter using the operating program for the drive.

Refer to Chapter 9 MN760-3 "Troubleshooting" if the communication is not operating normally.

*The User program or the "DriveView" program supplied from Baldor Electric can be used as the operating program for the drive.

E.8 Parameter Code List (Common Area)

Table E-7 Parameter Code List (Common Area)

<Common Area>: Area accessible regardless of inverter models (Note 3)

Address	Parameter	Scale	Unit	R/W	Data Value
0x0000	Inverter Model			R	0: N/A 1: N/A 2: N/A 3: N/A 4: VS1PF5 5: N/A 7: N/A 8: VS1SM 9: N/A A: VS1MD
0x0001	Inverter Capacity			R	FFFF 0.5Hp 0000 1.0Hp 0002 2.0Hp 0003 3.0Hp 0004 5.0Hp 0005 5.0Hp 0006 7.5Hp 0007 10.0Hp 0008 15.0Hp 0009 20.0Hp 000A 25.0Hp 000B 30.0Hp
0x0002	Inverter Input Voltage			R	0: 200V class 0 = 230V 1: 440V class 1 = 460V
0x0003	S/W Version			R	(Ex) 0x0010: Version 1.0 0x0011: Version 1.1
0x0004	Parameter Lock			R/W	0: Lock (default) 1: Unlock
0x0005	Frequency Reference	0.01	Hz	R/W	Starting freq. ~ Max freq.

Table E-7 Continued

Address	Parameter	Scale	Unit	R/W	Data Value
0x0006	Run Command			R/W	BIT 0: Stop (0->1) - 001 BIT 1: Forward Run (0->1) - 010 BIT 2: Reverse Run (0->1) - 100
				W	BIT 3: Fault Reset (0->1) BIT 4: Emergency Stop (0->1)
				-	BIT 5, BIT 15: Not Used
				R	BIT 6-7: Start/Stop, Source 00 (Terminal) 01 (Keypad) 10 (Reserved) 11 (Communication) BIT 8-12: Frequency Command 00000: DRV-00 00001: Not Used 00010-00100: Multi-Step Frequency 1-7 00101: Up 00110: Down 00111: UDZero 00100: V0 00101: V1 00110: I 00111: V0+I 01000: V1+I 01001: Jog 01010: PID 01011: Communication 20-31: Reserved
0x0007	Acceleration Time	0.1	sec	R/W	See Function List
0x0008	Deceleration Time	0.1	sec	R/W	
0x0009	Output Current	0.1	A	R	
0x000A	Output Frequency	0.01	Hz	R	
0x000B	Output Voltage	0.1	V	R	
0x000C	DC Link Voltage	0.1	V	R	
0x000D	Output Power	0.1	kW	R	

Table E-7 Continued

Address	Parameter	Scale	Unit	R/W	Data Value
0x000E	Inverter Status			R	BIT 0: Stop BIT 1: Forward Running BIT 2: Reverse Running BIT 3: Fault (Trip) BIT 4: Accelerating BIT 5: Decelerating BIT 6: Speed Arrival BIT 7: DC Braking BIT 8: Stopping BIT 9: Not Used BIT 10: Brake Open BIT 11: Forward Run Command BIT 12: Reverse Run Command BIT 13: REM. R/S BIT 14: REM. Frequency
0x000F	Trip Information			R	BIT 0: OCT BIT 1: OVT BIT 2: EXT-A BIT 3: EST (BX) BIT 4: COL BIT 5: GFT (Ground Fault) BIT 6: OHT (Inverter Overheat) BIT 7: ETH (Motor Overheat) BIT 8: OLT (Overload Trip) BIT 9: HW-Diag BIT 10: EXT-B BIT 11: EEP (Parameter Write Error) BIT 12: FAN (Lock and Open Error) BIT 13: PO (Phase Open) BIT 14: IOLT BIT 15: LVT

Table E-7 Continued

Address	Parameter	Scale	Unit	R/W	Data Value	
0x0010	Input Terminal Status			R	BIT 0: P1 BIT 1: P2 BIT 2: P3 BIT 3: P4 BIT 4: P5 BIT 5: P6 BIT 6: P7 BIT 7: P8	
0x0011	Output Terminal Status			R	BIT 0-3: Not Used BIT 4: MO (Multi-Output with OC) BIT 5-6: Not Used BIT 7: 3ABC	
0x0012	V1	0-3FF		R	Value corresponding to 0V~ +10V	
0x0013	V2	0-3FF		R	Value corresponding to 0V~ -10V input when setting Freq Mode to 2	
0x0014	I	0-3FF		R	Value corresponding to 0-20mA input	
0x0015	RPM			R	See Function List	
0x001A	Unit Display			R	Not Used	
0x001B	Pole Number			R	Not Used	
0x001C	Custom Version			R	Not Used	
0x001D	Trip Information-B			R	BIT 0: COM (I/O Board Reset) BIT 1: FLTL BIT 2: NTC BIT 3: REEP BIT 4:OC2 BIT 5: NBR BIT 6-15: Not Used	
0x001E	PID Feedback		Hz/%	W	Writes feedback amount when feedback is set by communication in PID drive.	
0x0100 - 0x0107	Read Address Register			R	0x0100: 166 0x0102: 168 0x0104: 170 0x0106: 172	0x0101: 167 0x0103: 169 0x0105: 171 0x0107: 173

Table E-7 Continued

Address	Parameter	Scale	Unit	R/W	Data Value	
0x0108 - 0x010F	Write Address Register			W	0x0108: 174 0x010A: 176 0x010C: 178 0x010E: 180	0x0109: 175 0x010B: 177 0x010D: 179 0x010F: 181

Note 1) The changed value in Common area affects the current setting but returns to the previous setting when power is cycled or Inverter is reset. However, changing value is immediately reflected in other parameter groups even in the case of Reset or Power On/Off.

Note 2) S/W version of Common area is displayed in 16 bit, while that of parameter area is displayed in 10 bit.

Note 3) VS1MD Models coded as A – SV-iG5A

Figure E-1 Speed Reference — Binary to Decimal to Hex

	Value	32767	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1	Speed Reference in decimal	Speed Reference in Frequency	Speed Reference in Hex
	Value				16	8	4	2	1											
	Bit Position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
	Bit Position	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
Speed Reference	0x0005	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	1000	10	3E8
	0x0005	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	2000	20	7D0
	0x0005	0	0	0	0	1	0	1	1	1	0	1	1	1	0	0	0	3000	30	BB8
	0x0005	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	4000	40	FA0
	0x0005	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	5000	50	1388
	0x0005	0	0	0	1	0	1	1	1	0	1	1	1	0	0	0	0	6000	60	1770

Figure E-2 Speed Reference Source — Command Source — Run Command

0x0006	Reserved			Freq Cmd					Start/Stop, Source		NA	CS	FR	RR	FR	ST	Total Value
	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	1	5057
	0	0	0	1	0	0	1	1	1	1	0	0	0	0	1	0	5058
	0	0	0	1	0	0	1	1	1	1	0	0	0	1	0	0	5060
	0	0	0	1	0	0	1	1	1	1	0	0	1	0	0	0	5064
	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	0	5072
5057				(Freq Source=Net)					(Freq Cmd Source =Comm)			(Run Cmd = Stop)					19+3+1
5058				(Freq Source=Net)					(Freq Cmd Source =Comm)			(Run Cmd = FwdRun)					19+3+2
5060				(Freq Source=Net)					(Freq Cmd Source =Comm)			(Run Cmd = RevRun)					19+3+4
5064				(Freq Source=Net)					(Freq Cmd Source =Comm)			(Run Cmd = Fault Reset)					19+3+8
5072				(Freq Source=Net)					(Freq Cmd Source =Comm)			(Run Cmd = Coast Stop)					19+3+16

E.9 Communications Protocol (CI485)

E.9.1 Basic Format

Table E-8 Command message (Request)

ENQ	Drive No.	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n bytes	2 bytes	1 byte

Table E-9 Normal response (Acknowledge Response)

ACK	Drive No.	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n*4 bytes	2 bytes	1 byte

Table E-10 Negative response (Negative Acknowledge Response)

NAK	Drive No.	CMD	Error Code	SUM	EOT
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Description:
- Request starts with “ENQ” and ends with “EOT”
- Acknowledge Response starts with “ACK” and ends with “EOT”
- Negative Acknowledge Response starts with “NAK” and ends with “EOT”
- “Drive Number” is the number of the drive and is indicated in 2 byte ASCII-HEX
- (ASCII-HEX: Hexadecimal consists of characters 0-9 and A - F)
- CMD: Upper Case Character

Table E-11

Character	ASCII-HEX	Command
R	52	Read
W	57	Write
X	58	Request for monitoring
Y	59	Action for monitoring

Data: ASCII-HEX
Ex) when data value is 3000: 3000 (dec) = '0' 'B' 'B' '8'h = 30h 42h 42h 38h

- Error code: ASCII (20h ~ 7Fh)
- Receive/Send buffer size: Receive= 39 bytes, Send=44 bytes
- Monitor register buffer: 8 Words
- SUM: to check the communication error

SUM= ASCII-HEX format of lower 8 bits of (Inverter No. + CMD + DATA)
Ex) Command Message (Request) for reading one address from address "9000"

Table E-12

ENQ	Drive No.	CMD	Address	Number of address to read	SUM	EOT
05h	"01" to "1F"	"R"	"3000"	"1"	"A7"	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

SUM= 0 + 1 + R + 3 + 0 + 0 + 0 + 1 = 30h + 31h + 52h + 33h + 30h + 30h + 30h + 31h = 1A7h
(control values such as ENQ/ACK/NAK are excluded)

E.9.2 Detail Communication Protocol

Read Request: Request for read successive 'N' number of WORD from address "XXXX"

Table E-13 Request for Read

ENQ	Drive No.	CMD	Address	Number of address to read	SUM	EOT
05h	"01" to "1F"	"R"	"XXXX"	"1" to "8" = n	"XX"	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

Total bytes = 12. The quotation marks (".") mean character.

Table E-14 Acknowledge Response

ACK	Drive No.	CMD	Address	SUM	EOT
06h	"01" to "1F"	"R"	"XXXX"	"XX"	04h
1 byte	2 bytes	1 byte	n*4 bytes	2 bytes	1 byte

Total bytes = 7 * n * 4 = Max. 39

Table E-15 Negative Acknowledge Response

NAK	Drive No.	CMD	Error Code	SUM	EOT
06h	"01" to "1F"	"R"	"**"	"XX"	04h
1 byte	2 bytes	1 byte	4 bytes	2 bytes	1 byte

Total bytes = 9

E.9.3 Detailed Write Protocol

Table E-16 Request for Write

ENQ	Drive No.	CMD	Address	Number of address to read	Data	SUM	EOT
05h	“01” to “1F”	“W”	“XXXX”	“1” to “8” = n	“XXXX”	“XX”	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	n*4 bytes	2 bytes	1 byte

Total bytes = 12 + n * 4 = Max. 44

Table E-17 Acknowledge Response

ACK	Drive No.	CMD	Address	SUM	EOT
06h	“01” to “1F”	“W”	“XXXX”	“XX”	04h
1 byte	2 bytes	1 byte	n*4 bytes	2 bytes	1 byte

Total bytes = 7 + n * 4 = Max. 39

Table E-18 Negative Response

NAK	Drive No.	CMD	Error Code	SUM	EOT
06h	“01” to “1F”	“W”	“**”	“XX”	04h
1 byte	2 bytes	1 byte	4 bytes	2 bytes	1 byte

Total bytes = 9

E.9.4 Detailed Monitor Register Protocol

- Monitor Register
- Request for Monitor Register

Monitor Register has the function to update data periodically after assigning the necessary data to be monitored continuously.

Request for Register of ‘n’ number of Addresses (non-successive)

Table E-19 Request for Monitor Register

ENQ	Drive No.	CMD	Address	Number of address to read	SUM	EOT
05h	“01” to “1F”	“X”	“XXXX”	“1” to “8” = n	“XX”	04h
1 byte	2 bytes	1 byte	n*4 bytes	1 byte	2 bytes	1 byte

Total bytes = 8 + n * 4 = Max. 40

Table E-20 Acknowledge Response

ACK	Drive No.	CMD	SUM	EOT
06h	“01” to “1F”	“X”	“XX”	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes = 7

Table E-21 Negative Acknowledge Response

NAK	Drive No.	CMD	Error Code	SUM	EOT
15h	“01” to “1F”	“X”	“**”	“XX”	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

- Monitor Action
- Action Request for Monitor Register: Request to read data registered by Monitor Register.

Table E-22 Action Request for Monitor Register

ENQ	Drive No.	CMD	SUM	EOT
05h	“01” to “1F”	“Y”	“XX”	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes = 8 + n * 4 = Max. 40

Table E-23 Acknowledge Response

ACK	Drive No.	CMD	Data	SUM	EOT
06h	“01” to “1F”	“Y”	“XXXX”	“XX”	04h
1 byte	2 bytes	1 byte	n*4 bytes	2 bytes	1 byte

Total bytes = 7

Table E-24 Negative Acknowledge Response

NAK	Drive No.	CMD	Error Code	SUM	EOT
15h	“01” to “1F”	“Y”	“**”	“XX”	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

E.9.5 Acknowledge Response Error Code Descriptions

Table E-25 Error Code Descriptions

Error Code	Description
1F	When master is sending codes other than Function code (R, W, X)
1A	When parameter address does not exist
1D	When Data value exceeds its permissible range during “W” (Write).
WM	When the specific parameters can not be written during “W” (Write). (For example, in the case of Read Only, Write disabled during Run.)
FE	When frame size of specific function is not correct and Checksum

E.10 Troubleshooting

Perform these checks when an RS485 communication error occurs.

Table E-26

Check	Corrective Measure
Is power provided to the converter?	Provide electric power to the converter.
Are the connections between converter and computer correct?	Refer to the converter manual.
Is Master not polling?	Verify the Master is polling the drive.
Is baud rate of computer and drive set correctly?	Set the correct value.
Is the data format of user program correct?	Set data formats to same for drive and computer.
Is the connection between the converter and the communication card correct?	Check for the correct wiring.

Table E-27 SCII Codes

Character	Hex	Character	Hex	Character	Hex	Character	Hex	Character	Hex
A	41	a	61	0	30	:	3A	DLE	10
B	42	b	62	1	31	;	3B	EM	19
C	43	c	63	2	32	<	3C	ACK	06
D	44	d	64	3	33	=	3D	ENQ	05
E	45	e	65	4	34	>		EOT	04
F	46	f	66	5	35	?	3E	ESC	1B
G	47	g	67	6	36	@	3F	ETB	17
H	48	h	68	7	37	[	40	ETX	03
I	49	i	69	8	38	\	5B	FF	0C
J	4A	J	6A	9	39	]	5C	FS	1C
K	4B	k	6B	space	20		5D	GS	1D
L	4C	l	6C	!	21		5E	HT	09
M	4D	m	6D	”	22		5F	LF	0A
N	4E	n	6E	#	23	{	60	NAK	15
O	4F	o	6F	$	24	|	7B	NUL	00
P	50	p	70	%	25	}	7C	RS	1E
Q	51	q	71	&	26	to	7D	S1	0F
R	52	r	72	'	27	BEL	7E	SO	0E
S	53	s	73	(	28	BS	07	SOH	01
T	54	t	74	)	29	CAN	08	STX	02
U	55	u	75	*	2A	CR	18	SUB	1A
V	56	v	76	+	2B	DC1	0D	SYN	16
W	57	w	77	,	2C	DC2	11	US	1F
X	58	x	78	-	2D	DC3	12	VT	0B
Y	59	y	79	.	2E	DC4	13		
Z	5A	z	7A	/	2F	DEL	14		
							7F		

Baldor District Offices

UNITED STATES

ARIZONA
PHOENIX
4211 S 43RD PLACE
PHOENIX, AZ 85040
PHONE: 602-470-0407
FAX: 602-470-0464

ARKANSAS
CLARKSVILLE
1001 COLLEGE AVENUE
CLARKSVILLE, AR 72830
PHONE: 479-754-9108
FAX: 479-754-9205

CALIFORNIA
LOS ANGELES
6480 FLOTILLA STREET
COMMERCE, CA 90040
PHONE: 323-724-6771
FAX: 323-721-5859

HAYWARD
21056 FORBES AVENUE
HAYWARD, CA 94545
PHONE: 510-785-9900
FAX: 510-785-9910

COLORADO
DENVER
3855 FOREST STREET
DENVER, CO 80207
PHONE: 303-623-0127
FAX: 303-595-3772

CONNECTICUT
WALLINGFORD
65 SOUTH TURNPIKE ROAD
WALLINGFORD, CT 06492
PHONE: 203-269-1354
FAX: 203-269-5485

FLORIDA
TAMPA/PUERTO RICO/
VIRGIN ISLANDS
3906 EAST 11TH AVENUE
TAMPA, FL 33605
PHONE: 813-248-5078
FAX: 813-247-2984

GEORGIA
ATLANTA
62 TECHNOLOGY DRIVE
ALPHARETTA, GA 30005
PHONE: 770-772-7000
FAX: 770-772-7200

ILLINOIS
CHICAGO
340 REMINGTON BLVD.
BOLINGBROOK, IL 60440
PHONE: 630-296-1400
FAX: 630-226-9420

INDIANA
INDIANAPOLIS
5525 W. MINNESOTA STREET
INDIANAPOLIS, IN 46241
PHONE: 317-246-5100
FAX: 317-246-5110

IOWA
DES MOINES
1800 DIXON STREET, SUITE C
DES MOINES, IA 50316
PHONE: 515-263-6929
FAX: 515-263-6515

MARYLAND
BALTIMORE
6660 SANTA BARBARA RD.
SUITES 22-24
ELKRIDGE, MD 21075
PHONE: 410-579-2135
FAX: 410-579-2677

MASSACHUSETTS
BOSTON
6 PULLMAN STREET
WORCESTER, MA 01606
PHONE: 508-854-0708
FAX: 508-854-0291

MICHIGAN
DETROIT
5993 PROGRESS DRIVE
STERLING HEIGHTS, MI 48312
PHONE: 586-978-9800
FAX: 586-978-9969

MINNESOTA
MINNEAPOLIS
21080 134TH AVENUE NORTH
ROGERS, MN 55374
PHONE: 763-428-3633
FAX: 763-428-4551

MISSOURI
ST LOUIS
422 INDUSTRIAL DRIVE
MARYLAND HEIGHTS, MO 63043
PHONE: 314-298-1800
FAX: 314-298-7660

KANSAS CITY
1501 BEDFORD AVENUE
NORTH KANSAS CITY, MO 64116
PHONE: 816-587-0272
FAX: 816-587-3735

NEW YORK
AUBURN
ONE ELLIS DRIVE
AUBURN, NY 13021
PHONE: 315-255-3403
FAX: 315-253-9923

NORTH CAROLINA
GREENSBORO
1220 ROTHERWOOD ROAD
GREENSBORO, NC 27406
PHONE: 336-272-6104
FAX: 336-273-6628

OHIO
CINCINNATI
2929 CRESCENTVILLE ROAD
WEST CHESTER, OH 45069
PHONE: 513-771-2600
FAX: 513-772-2219

CLEVELAND
8929 FREEWAY DRIVE
MACEDONIA, OH 44056
PHONE: 330-468-4777
FAX: 330-468-4778

OKLAHOMA
TULSA
7170 S. BRADEN, SUITE 140
TULSA, OK 74136
PHONE: 918-366-9320
FAX: 918-366-9338

OREGON
PORTLAND
20393 SW AVERY COURT
TUALATIN, OR 97062
PHONE: 503-691-9010
FAX: 503-691-9012

PENNSYLVANIA
PHILADELPHIA
1035 THOMAS BUSCH
MEMORIAL HIGHWAY
PENNSAUKEN, NJ 08110
PHONE: 856-661-1442
FAX: 856-663-6363

PITTSBURGH
159 PROMINENCE DRIVE
NEW KENSINGTON, PA 15068
PHONE: 724-889-0092
FAX: 724-889-0094

TENNESSEE
MEMPHIS
4000 WINCHESTER ROAD
MEMPHIS, TN 38118
PHONE: 901-365-2020
FAX: 901-365-3914

TEXAS
DALLAS
2920 114TH STREET SUITE 100
GRAND PRAIRIE, TX 75050
PHONE: 214-634-7271
FAX: 214-634-8874

HOUSTON
10355 W. LITTLE YORK ROAD
SUITE 300
HOUSTON, TX 77041
PHONE: 281-977-6500
FAX: 281-977-6510

UTAH
SALT LAKE CITY
2230 SOUTH MAIN STREET
SALT LAKE CITY, UT 84115
PHONE: 801-832-0127
FAX: 801-832-8911

WISCONSIN
MILWAUKEE
1960 SOUTH CALHOUN ROAD
NEW BERLIN, WI 53151
PHONE: 262-784-5940
FAX: 262-784-1215

INTERNATIONAL SALES
FORT SMITH, AR
P.O. BOX 2400
FORT SMITH, AR 72902
PHONE: 479-646-4711
FAX: 479-648-5895

CANADA
EDMONTON, ALBERTA
4053-92 STREET
EDMONTON, ALBERTA T6E 6R8
PHONE: 780-434-4900
FAX: 780-438-2600

TORONTO
OAKVILLE, ONTARIO
2750 COVENTRY ROAD
OAKVILLE, ONTARIO L6H 6R1
PHONE: 905-829-3301
FAX: 905-829-3302

MONTREAL, QUEBEC
5155 J-ARMAND BOMBARDIER
SAINT-HUBERT, QUÉBEC
CANADA J3Z 1G4
PHONE: 514-933-2711
FAX: 514-933-8639

VANCOUVER,
BRITISH COLUMBIA
1538 KEBET WAY
PORT COQUITLAM,
BRITISH COLUMBIA V3C 5M5
PHONE 604-421-2822
FAX: 604-421-3113

WINNIPEG, MANITOBA
54 PRINCESS STREET
WINNIPEG, MANITOBA R3B 1K2
PHONE: 204-942-5205
FAX: 204-956-4251

AUSTRALIA
UNIT 3, 6 STANTON ROAD
SEVEN HILLS, NSW 2147, AUSTRALIA
PHONE: (61) (2) 9674 5455
FAX: (61) (2) 9674 2495

UNIT 8, 5 KELLETTS ROAD
ROWVILLE, VICTORIA, 3178 AUSTRALIA
PHONE: (61) (3) 9753 4355
FAX: (61) (3) 9753 4366

EL SALVADOR
RESIDENCIAL PINARES DE SUIZA
POL. 15 #44,
NVA. SAN SALVADOR, EL SALVADOR
PHONE: +503 2288-1519
FAX: +503 2288-1518

CHILE
LUIS THAYER OJEDA 166,
OF 402 - PROVIDENCIA
SANTIAGO, CHILE
PHONE: +56 2 816 9900

CHINA
160 SONG SHENG ROAD
SONGJIANG INDUSTRY ZONE
SHANGHAI 201613, CHINA
PHONE: +86 21 5760 5335
FAX : +86 21 5760 5336

GERMANY
HERMANN-HEINRICH - GOSSEN 3
50858 KOLN, GERMANY
PHONE: 49-2234379410
FAX: 49-223437941 64

DIESELSTRASSE 22
D-85551 KIRCHHEIM
MUNICH, GERMANY
PHONE: +49 89 90 5080
FAX: +49 89 90 50 8492

INDIA
14, COMMERCE AVENUE
MAHAGANESH COLONY
PAUD ROAD
PUNE - 411038
MAHARASHTRA, INDIA
PHONE: +91 20 25 45 27 17 / 18
FAX: +91 20 25 45 27 19

INDONESIA
TALAVERA OFFICE PARK,
28TH FLOOR, SUITE M18
JL. T.B. SIMATUPANG, KAV. 22-26
JAKARTA 12430, INDONESIA
PHONE: +62 21 7599 9879
FAX: + 62 21 7599 9878

ITALY
VIA SOTTOBISIO 30
BALERNA CH-6828
PHONE: +41 91 683 6161
FAX: +41 91 630 2633

JAPAN
DIA BLDG 802,
2-21-1 TSURUYA-CHO,
KANAGAWA-KU
YOKOHAMA, 221-0835, JAPAN
PHONE: 81-45-412-4506
FAX: 81-45-412-4507

MEXICO
LEON, GUANAJUATO
KM. 2.0 BLVD. AEROPUERTO
LEÓN 37545, GUANAJUATO, MÉXICO
PHONE: +52 477 761 2030
FAX: +52 477 761 2010

MIDDLE EAST & NORTH AFRICA
VSE INTERNATIONAL CORP.
P. O. BOX 5618
BUFFALO GROVE, IL 60089-5618
PHONE: 847 590 5547
FAX: 847 590 5587

PANAMA
AVE. RICARDO J. ALFARO
EDIFICIO SUN TOWERS MALL
PISO 2, LOCAL 55
CIUDAD DE PANAMÁ, PANAMÁ
PHONE: +507 236-5155
FAX: +507 236-0591

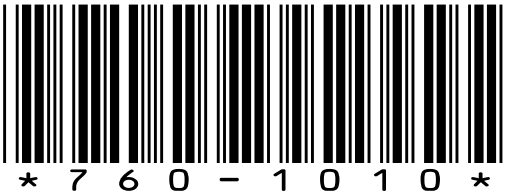
SINGAPORE
18 KAKI BUKIT ROAD 3, #03-09
ENTREPRENEUR BUSINESS CENTRE
SINGAPORE 415978
PHONE: (65) 6744 2572
FAX: (65) 6747 1708

SWITZERLAND
POSTFACH 73
SCHUTZENSTRASSE 59
CH-8245 FEUERTHALEN
SWITZERLAND
PHONE: +41 52 647 4700
FAX: +41 52 659 2394

TAIWAN
1F, NO 126 WENSHAN 3RD STREET,
NANTUN DISTRICT,
TAICHUNG CITY 408
TAIWAN R.O.C
PHONE: (886) 4 238 04235
FAX: (886) 4 238 04463

UNITED KINGDOM
6 BRISTOL DISTRIBUTION PARK
HAWKLEY DRIVE
BRISTOL BS32 0BF U.K.
PHONE: +44 1454 850000
FAX: +44 1454 859001

VENEZUELA
AV. ROMA. QTA EL MILAGRO. URB.
CALIFORNIA NORTE
CARACAS, 1070
VENEZUELA
PHONE/FAX: +58 212 272 7343
MOBILE: +58 414 114 8623



Baldor Electric Company
World Headquarters
P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792,
International Fax (1) 479.648.5895
www.baldor.com

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